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PIPE LINE INDUSTRY

Gulf Publishing Company, 1958

SEPTEMBER
1958

SPECIAL MAINTENANCE REPORT

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POWER BOOSTER
Bearing Care Extends Machinery Life 40

CLEANER LINES
Single Scraper Fits 18 to 24-Inch Pipe 45

REPAIR GUIDE
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Test Channel Guards Control Circuit 52

ACCURATE MEASUREMENT
Troubleshooting Tips For PD Meters 54

CONSTRUCTION PROGRESS
New Methods Speed Laurel Line Work 62

For a "Quick Look" at this issue, turn the page .

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PIPE LINE INDUSTRY

CONTENTS and Quick Look

September, 1958 Vol. 9, No. 3

To help you put first things first, scan these time-saving digests, checking ☑ those you want to read first.

Lengthen Life of Anti-Friction Bearings—(Part 1) —Checklist for Maintenance

☐ Here is a thorough guide to fundamental maintenance procedures for ball and roller bearings that will extend equipment service life. Both maintenance recommendations and effects of basic design features will be covered. In this first part you will find a detailed trouble shooting chart that will be useful either in the shop or field.

By Johnny Riddle ..... Page 40

Variable-Diameter Scraper Simplifies Line Maintenance

☐ Service Pipe Line Company's policy of connecting pipe line loops of several different diameters into a continuous line required the development of this new variable-diameter scraper. Having passed its initial tests, the working model is now being readied for main line maintenance service.

By Richard F. Gavitt ..... Page 45

Maintenance and Repair Practices for Pipe Line Lubricated Plug Valves

☐ Prolong valve life with planned preventive maintenance. Here's an outline of a program that can be adjusted to the individual needs of any company; also included is a guide to lubrication periods, cleaning and repair of plug valves.

By Paul A. Manor ..... Page 48

Guard and Circuit Testing Channel

☐ Increasing use of automatic and unattended stations has made the problem of maintenance take on an entirely new form. In the past much work that was termed maintenance was actually repair. Complicated equipment used for encoding and decoding supervisory control signals must be kept operating if line operation is to be reliable. Here is a method which allows the dispatcher to check such circuits and be sure they are operating properly.

By W. J. Benton ..... Page 52

PD Meters—Selection and Care

☐ For a positive displacement meter to maintain the accuracy required, it must be kept in good repair and calibrated on a regular schedule. Selection of the proper meter for the installation is an important step in assuring satisfactory service from the meter. Here is a discussion of important steps in selection, maintenance and calibration of PD meters for pipe line operations.

By Paul A. Mankin ..... Page 54

Reduce Electrical Equipment Downtime

☐ Insulation resistance testing is a must in any electrical equipment preventive maintenance program. The program should be set up for regular periodic checks; schedule depends on type of equipment and location. Working equipment requires more frequent testing than wiring, insulators and other non-moving, non-cycling apparatus.

By Richard W. Inman ..... Page 57

Pigging Gas Gathering System at 40 Below

☐ If you're making plans for this winter's line maintenance work, this pictorial report on Westcoast Transmission Co. Ltd.'s gathering system pigging program of last winter is worthwhile reading. Special clothing, oxygen masks for protection against hydrogen sulfide vapors and training in teamwork cut launching and recovery time to less than three minutes.

By James Joseph ..... Page 60

Work Moves Ahead as Laurel Line Crosses Mountains, Rivers

☐ Laying pipe over the Tuscarora Mountains and through some of the choicest farm lands in the country would give contractors enough headaches in normal weather. Add to it 29 days of rain in a 31-day work period, and it becomes the near impossible. Despite weather-caused delays, contractors on the six spreads between Philadelphia and Cleveland are moving toward a scheduled fall completion goal on the Laurel Pipe Line Company products line. Two "mile-wide" river crossings were also laid in the project.

By Melvin A. Judah ..... Page 62

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PIPE LINE INDUSTRY published every month. Entered as second class mail matter July 9, 1954, at the post office at Houston, Texas, under the act of March 3, 1879.

How High Can Prices Go?

There is one certainty you can count on in these uncertain times: If something isn't done to stop it, the U.S. inflationary spiral will reach the moon well ahead of our rockets.

Inflation exploded another booster rocket early last month when the steel industry raised its prices 3 percent because it couldn't absorb a 26 cents-per-hour wage increase. In turn, suppliers were forced to pass the higher prices on to oil industry equipment purchasers.

The U.S. oil industry is not in any position to absorb increased wage and materials costs, although this benevolent practice has almost become a habit. Within the past five years (June, 1953-June, 1958), the U.S. Bureau of Labor statistics reports that oil field machinery prices increased 23.4 percent, oil well alloy casing prices increased 48.5 percent and oil well carbon casing prices increased 36.1 percent. Between June, 1953 and December, 1957 average oil production wages jumped 24.5 percent.

Yet, the price of crude oil increased only 10.7 percent between June, 1953 and June, 1958.

This remarkable record of holding back prices in the face of rising wage and materials costs is a great tribute to the U.S. oil industry. But, you can't put tributes in the bank. Oil company mid-year reports show a substantial decrease in profits. The margin between cost and the price of crude and refined products already is too narrow to permit the industry to absorb another increase in operating costs.

This puts the industry squarely between the devil and the deep blue sea. Two perennial barriers stand firmly in the way of the sorely needed oil price increase:

- The depressing influence on markets of large quantities of cheaper foreign oil, which has not only driven U.S. oil almost completely out of international markets but also has weakened domestic price structures. Spiraling costs already have priced U.S. oil out of competition. Any additional increase in U.S. oil prices would further reduce its ability to compete with foreign oil. (This also is true of many other U.S. industries.)
- An oil price increase would invite another anti-trust investigation and add fuel to business critics' efforts for federal price control. Wisconsin's Republican Senator Wiley has asked why price controls should not be clamped on steel to protect the public against inflation. Tennessee's Democratic Senator Kefauver has said he will urge an investigation of industry pricing before Congress adjourns.

It will take raw courage for the oil industry to raise prices in the face of such obstacles. While higher prices would further reduce the ability of U.S. oil to compete with foreign oil, this may well be the only alternative.

Unless some price adjustment is made to compensate for higher costs, the U.S. oil industry faces serious financial troubles. It will not have sufficient funds to drill enough wells, and to install adequate new producing, refining and pipe line facilities to maintain the industry's ability to supply the nation's needs.

An assured, ample supply of oil is vital to the economic, industrial and military welfare of the U.S. This supply must be accessible under the most imaginable adverse conditions, which means it must be in North America. To maintain an adequate, accessible supply, the U.S. oil industry must have healthy financial conditions.

Something must be done to stop inflationary price increases in the U.S. It cannot be accomplished as long as higher wages increase costs. Labor and management should set about to take the bull by the horns. Both groups would have to agree to hold the line.

If industry doesn't do something along these lines, it is conceivable that government price controls may not be too far away. This would be pure socialism, and would stop the country's progress dead in its tracks.

Something must be done to bring U.S. prices out of orbit and back to earth. They can't keep going up forever.

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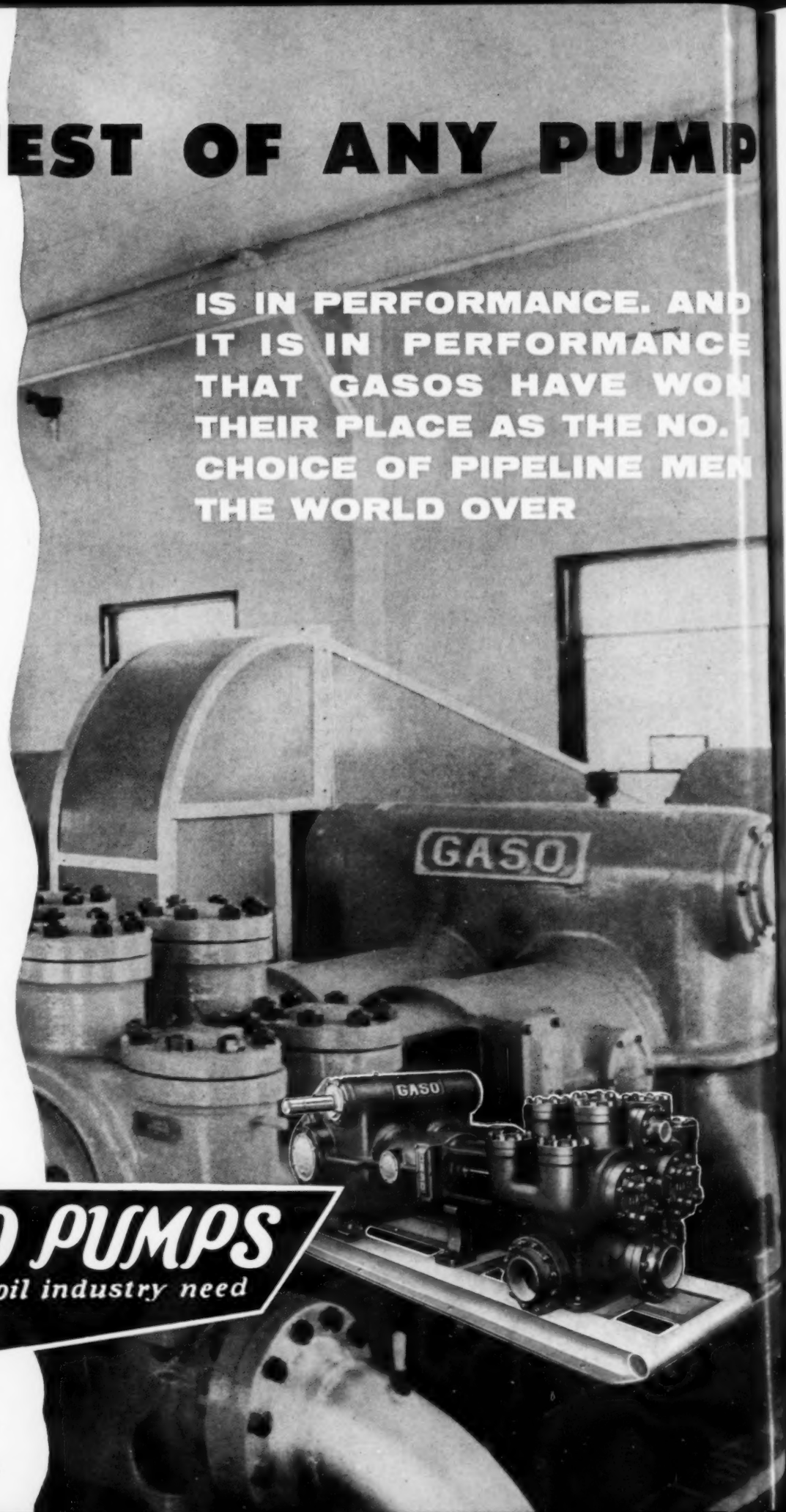

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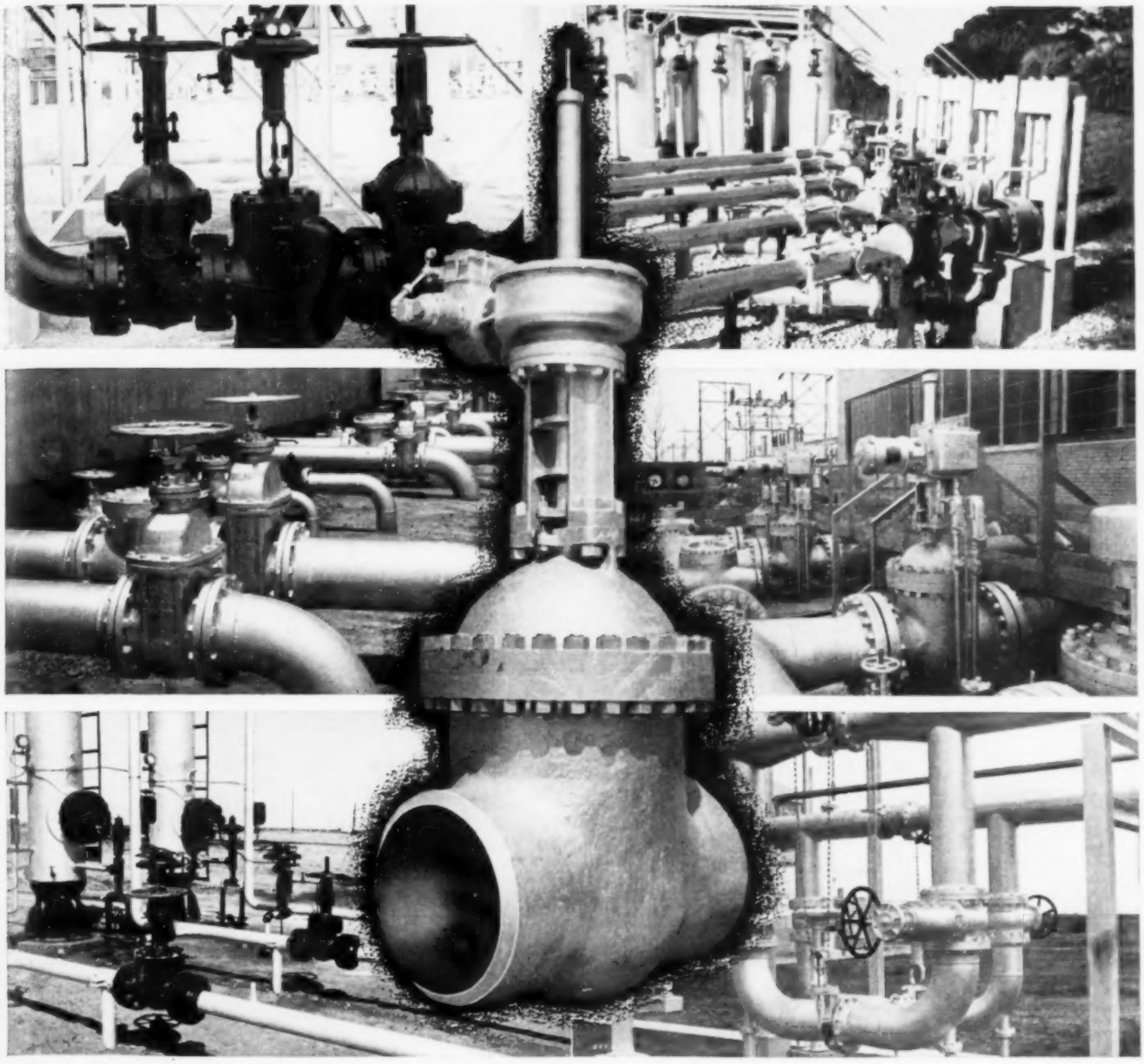

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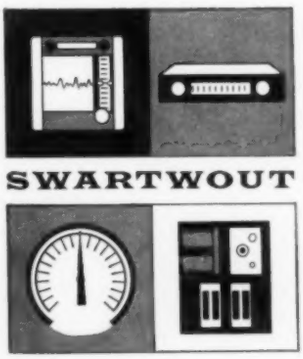

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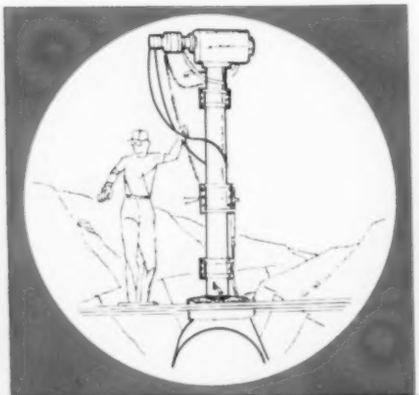

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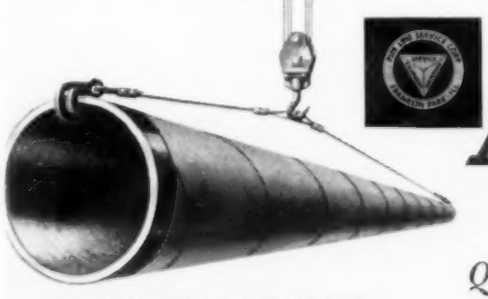

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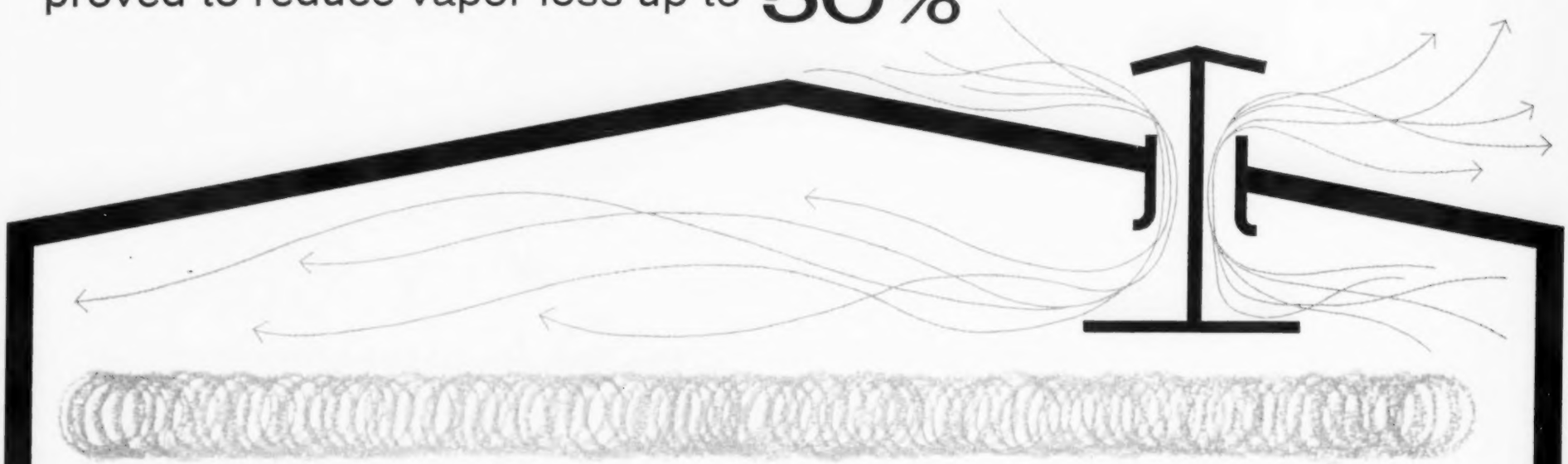

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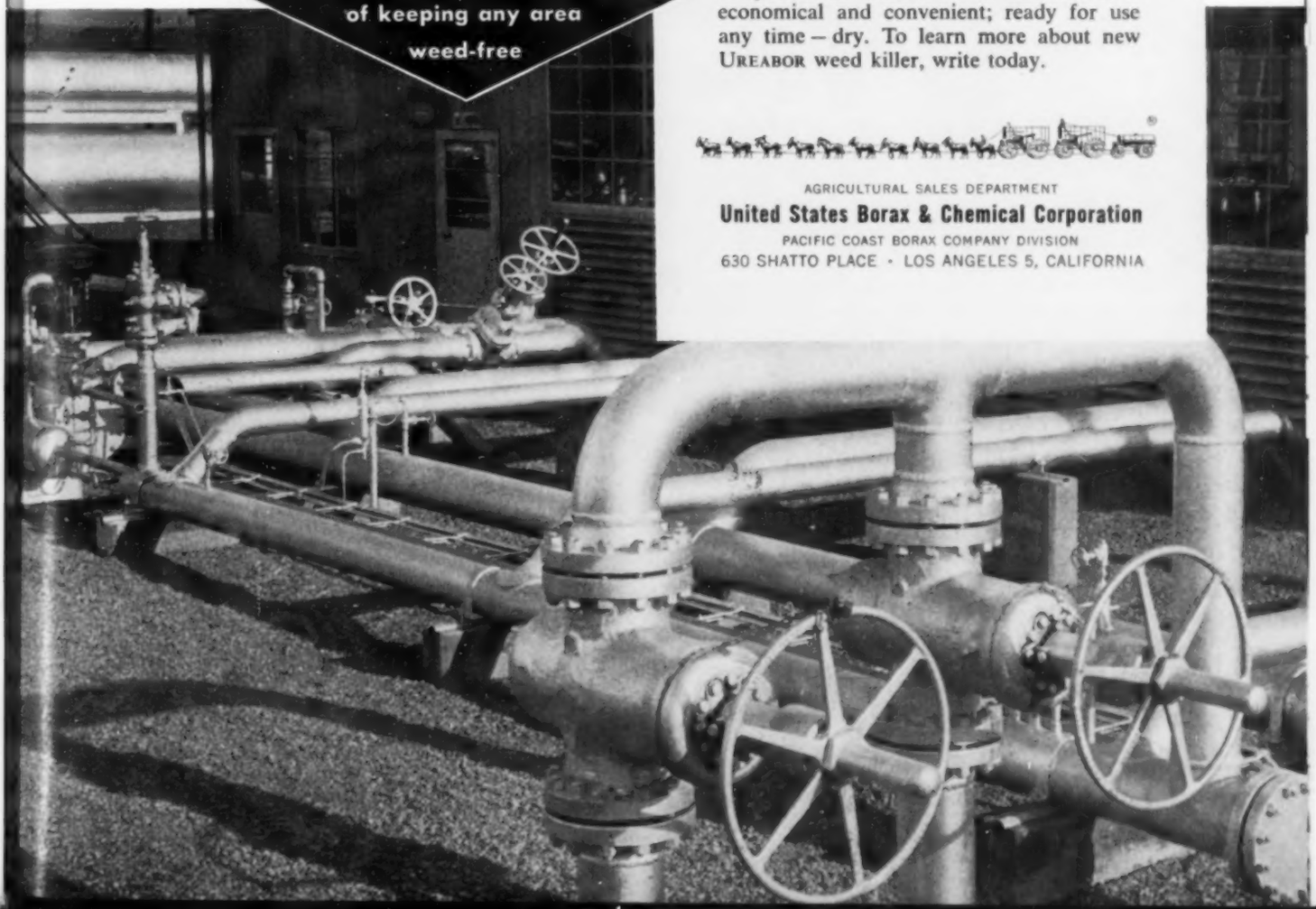

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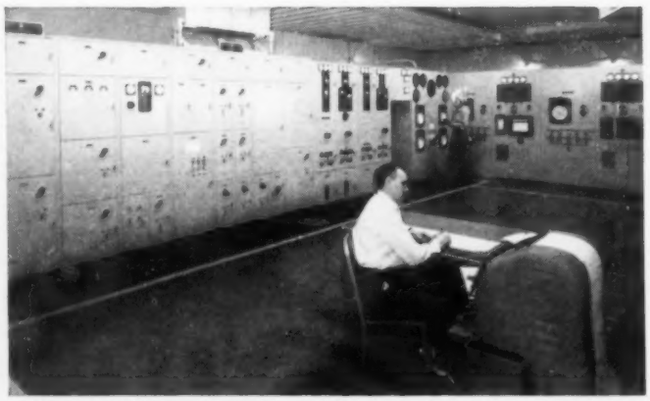

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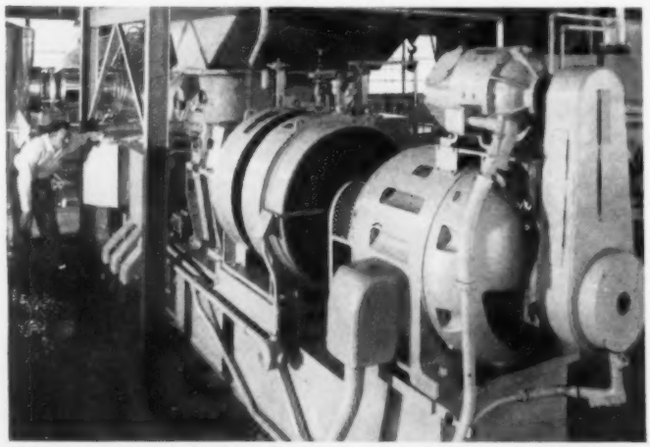

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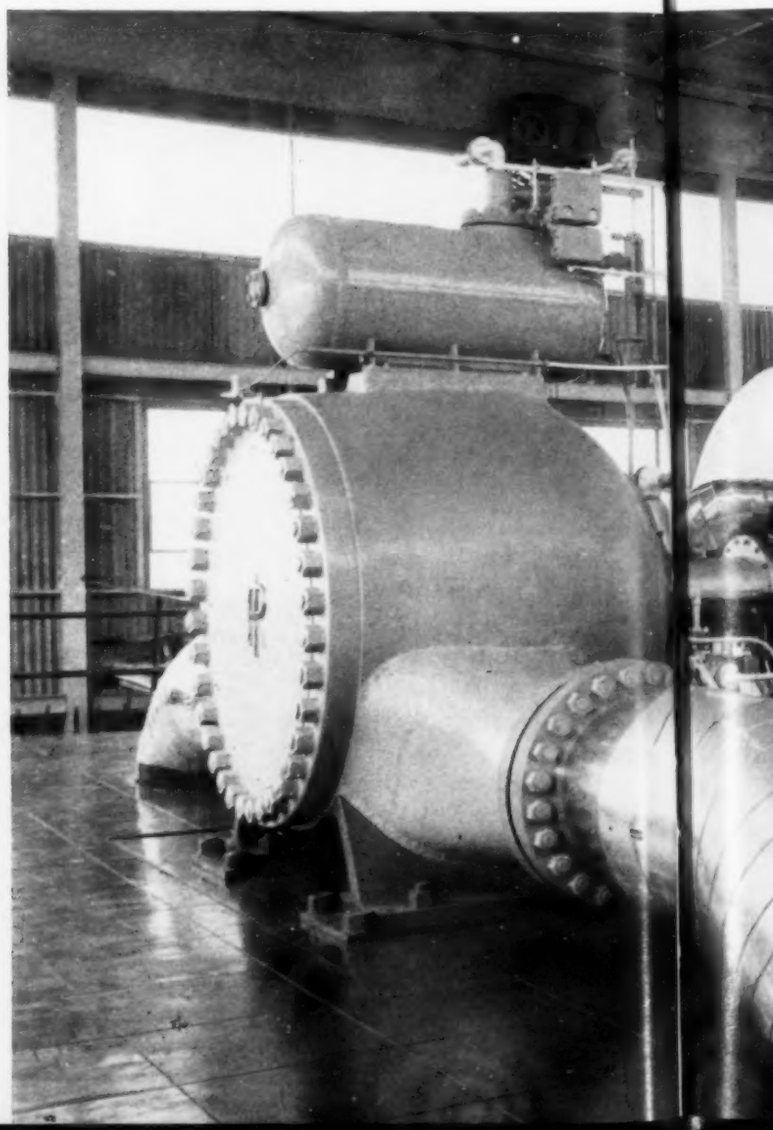

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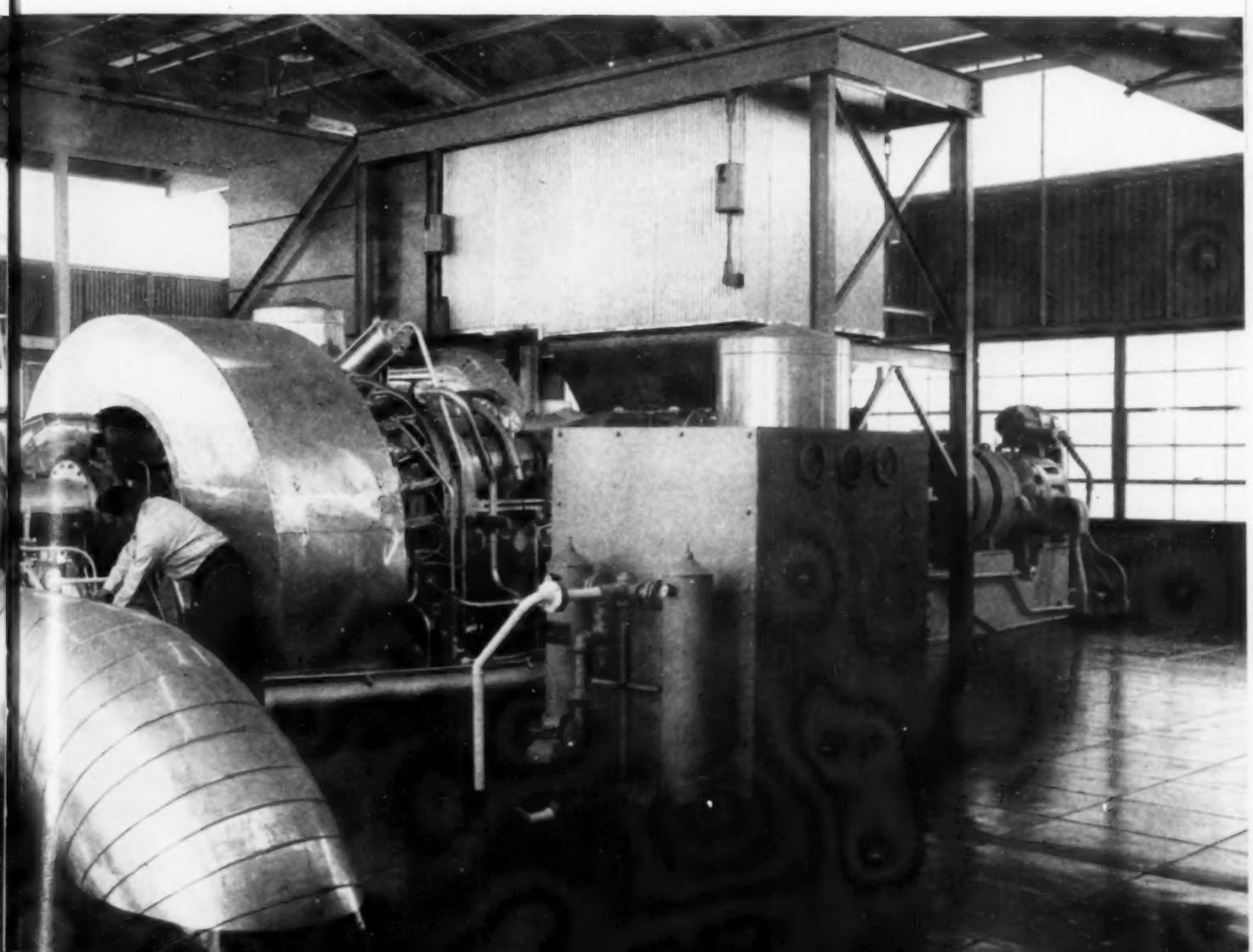

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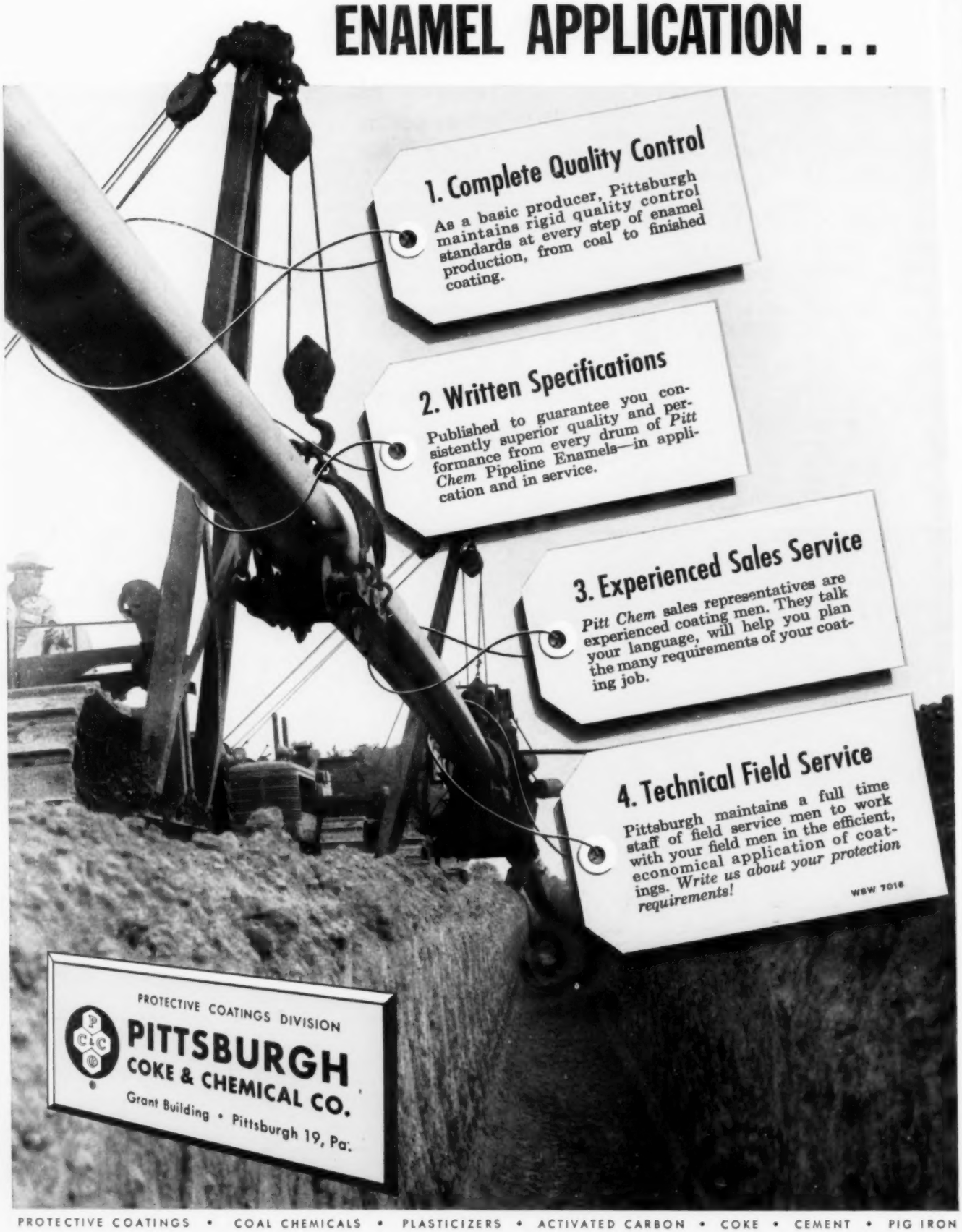
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Pitt Chem sales representatives are experienced coating men. They talk your language, will help you plan the many requirements of your coating job.
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Pittsburgh maintains a full time staff of field service men to work with your field men in the efficient, economical application of coatings. *Write us about your protection requirements!*
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REPEAT BUSINESS *from Old Clients is a familiar story at Brown & Root*

many happy **RETURNS...**

Brown & Root's reputation for completing jobs ahead of schedule and at lower costs, with the work done right, is bringing back old customers year after year. One example is Diamond Alkali Company. We built the original Deer Park, Texas, chemical plant in 1948. In the past ten years we were called back for four major plant expansions. No testimonial for Brown & Root could be more eloquent.

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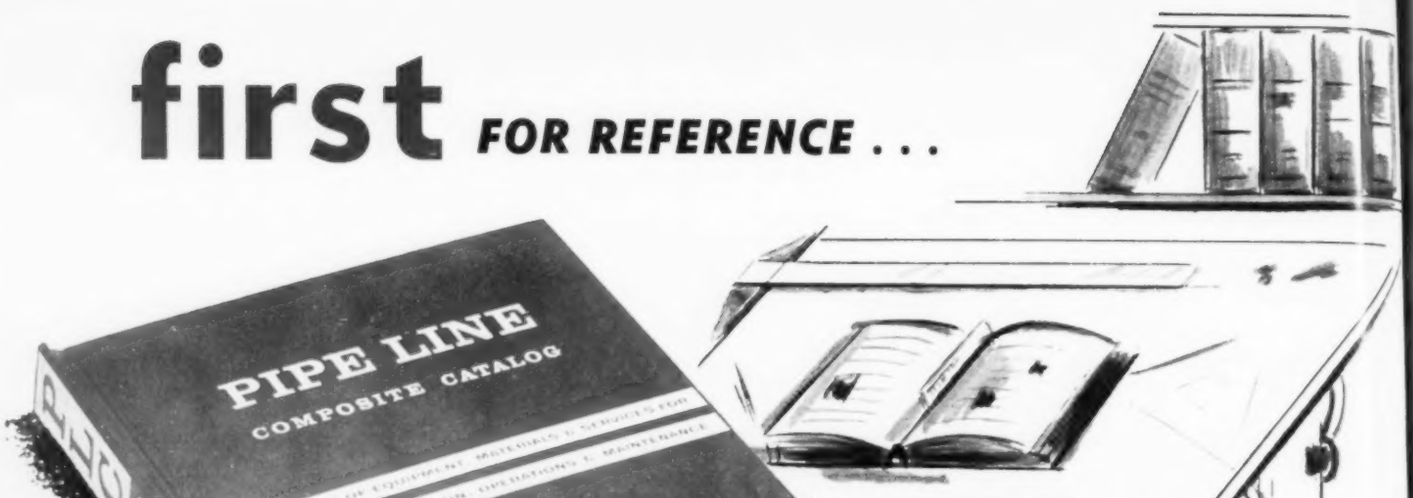

A one-volume reference library for purchasing and specifying. That's the best way to describe the only comprehensive catalog data file published specially for the Pipe Line Industry. Convenient to handle, thoroughly indexed, it is saving time and money for thousands of pipe line men.

first FOR INFORMATION ON MANUFACTURERS AND SERVICE COMPANIES

Included in 147 equipment and service company data in PLCC, there are 1,627 manufacturers' representatives and sources of supply listed.

first FOR INDIVIDUAL EQUIPMENT AND SERVICE ITEMS

There are 11,148 items of equipment and service items cataloged, with detailed information on specifications, installation, operation, maintenance, service—an entire library of useful reference.

first FOR CONSTRUCTION EQUIPMENT AND SERVICE

Pipe Line construction and service items listed in PIPE LINE COMPOSITE CATALOG total 390 . . . an invaluable aid to office and field specifications and purchases.

When you are ready to buy or specify, or if you just want planning information, look first in PIPE LINE COMPOSITE CATALOG.

These leading manufacturers, suppliers and service companies have filed complete or condensed catalog data in the current edition of the new PIPE LINE COMPOSITE CATALOG. See their detailed information in the catalog when you are ready to buy.

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The Aerotec Corp.
M. N. Aitken Co.
Alco Products, Inc.
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PIPE LINE COMPOSITE CATALOG

Published by PIPE LINE INDUSTRY

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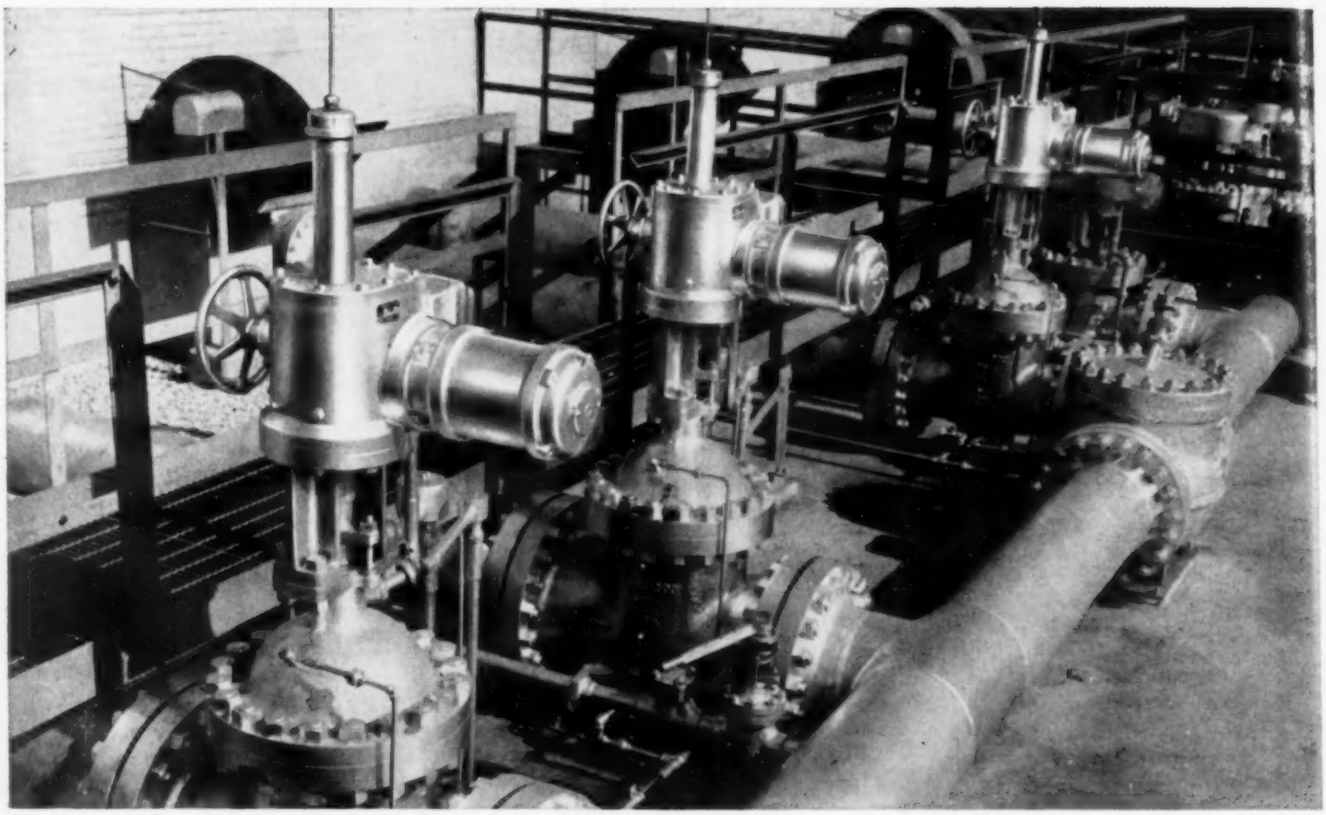
LimiTorque VALVE OPERATORS...



. . . for mainline crude-oil pipeline service at Cushing, Okla. Pumping Station of Shell Pipeline Co.

The valves shown above are 12" Venturi type manufactured by Darling Valve & Manufacturing Co., and they are push-button opened and closed by LimiTorque Motorized Valve Controls . . . dependably, safely and speedily. High pressure gas and oil transmission lines and refineries throughout the World are using LimiTorque to automatically open and close valves from a conveniently located control point—eliminating guesswork and reducing labor costs. One man can operate any type of valve quickly and dependably in remote, inaccessible or hazardous locations; thus vital pipeline and refinery operating procedure can be handled easily by key personnel, safely and economically . . . Also, LimiTorque eliminates any possible damage to vital valve parts in closing, due to its unique torque limiting mechanism. LimiTorque may be actuated by any available power source, such as Electricity, Oil, Gas, Air or Water; and is available for Micro-wave control. LimiTorque controls can be field-mounted on existing valves—contact your valve manufacturer, or nearest sales-engineering office.

Cushing Station is the initiating station on the Ozark Pipe Line System, operated by Shell Pipe Line Corporation for itself and as contractor for the other undivided interest owner, The Texas Pipe Line Co.

Send for Catalog L-550, and please use your Business Letterhead when requesting a copy.

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INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID AGITATORS • FLEXIBLE COUPLINGS
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DURA-GLAZE is a fused ceramic finish on aluminum plate or cast aluminum. When fired at 985 degrees F., the ceramic penetrates the aluminum, bonding tightly to it. The DURA-GLAZE finish will not shatter or rust under impact . . . will not deteriorate when exposed to salt water or industrial vapors.

**ceramic porcelain*

MARKER-VENT

With Separate Sign Panel Bolted to Vent

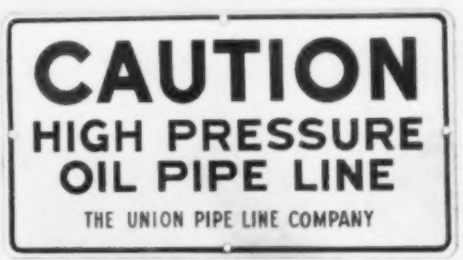
Offers choice of using new DURA-GLAZE aluminum plate sign or cast aluminum sign with DURA-GLAZE finish.

The one-piece, cast aluminum Marker-Vent is also available with DURA-GLAZE finish.

ALUMINUM PLATE SIGNS

With Dura-Glaze Finish

Signs of all sizes in complete range of colors made to your specifications to fit existing posts or mounting brackets.



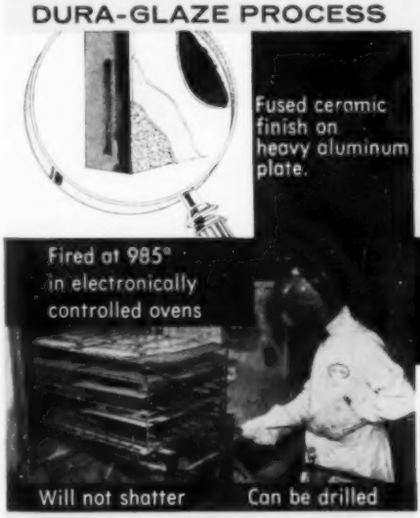
AERIAL MARKER NUMBER PLATES

With Dura-Glaze Finish

Made in your choice of colors and sizes to fit existing frames. Available as individual number plates, or as two and three numbers on one plate.

DURA-GLAZE finish is also standard on all L & M Model A and B Air View Markers.

DURA-GLAZE PROCESS


Fused ceramic finish on heavy aluminum plate.
Fired at 985° in electronically controlled ovens
Will not shatter
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Write for complete product catalog and sample DURA-GLAZE *plate for testing.*

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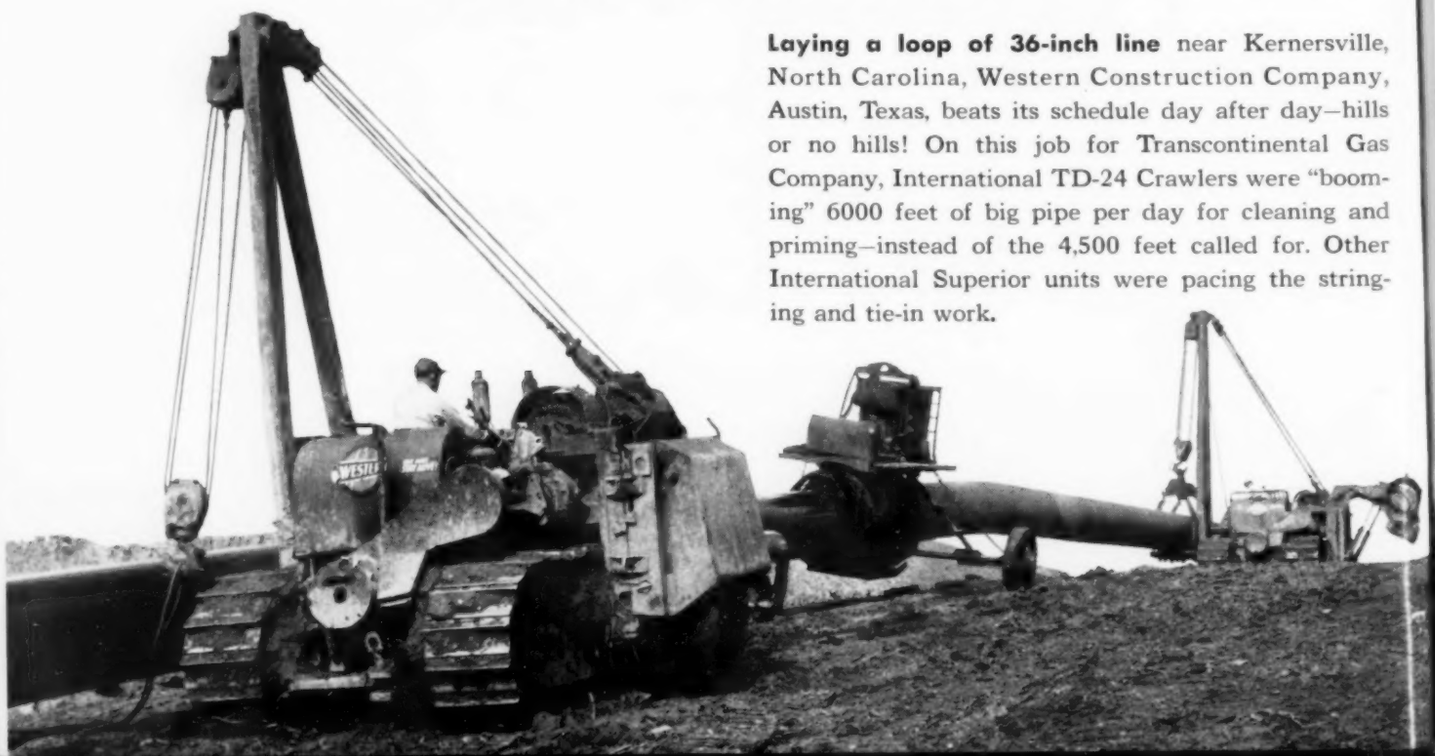
This quick-governing, fuel-thrifty engine on doping detail for Western Construction Company is only one of many International power units on the spread!

Exclusive TD-24 Planet Power steering gives positive, full-time control for precision pipe-handling—upgrade or down. Much line-looping was done on hilly terrain!

Pipeliners in a hurry beat tight schedules ...with Planet Power-

Laying a loop of 36-inch line near Kernersville, North Carolina, Western Construction Company, Austin, Texas, beats its schedule day after day—hills or no hills! On this job for Transcontinental Gas Company, International TD-24 Crawlers were "booming" 6000 feet of big pipe per day for cleaning and priming—instead of the 4,500 feet called for. Other International Superior units were pacing the stringing and tie-in work.



steered TD-24 sidebooms!

"TD-24's are schedule keepers"

"I find dependable TD-24 sidebooms always enable me to maintain the doping schedule, under all terrain conditions," states M. W. Blue, foreman of doping operations. "I like TD-24 Planet Power steering for keeping pipe alignment while carrying, especially in hilly terrain."

For precision pipe-handling control, uphill or down, exclusive TD-24 Planet Power steering lets you feed full-time "live" power to both tracks. You turn smoothly, as sharply or gradually as desired—without jerks! Exclusive TD-24 finger-tip hydraulic braking and foot decelerator give positive pipe-carrying control. And the exclusive TD-24 margin of flotation means bog-beating emergency action traction.

Prove the 130,000 lb. lift capacity—and all the other spread-speeding International Superior TD-24 sideboom advantages. Measure the downtime-prevention value of exclusive wear-saving fleeting sheaves. See your International Superior Distributor for a demonstration!

These two International Superior TD-24 sidebooms have the key assignment of handling big lengths of the 36" pipe for the clearing and doping crew. Operators have the exclusive super-safety and operating ease of reach-easy controls in vertical cluster!

International Harvester Company, Chicago 1, Illinois

INTERNATIONAL®

SUPERIOR®

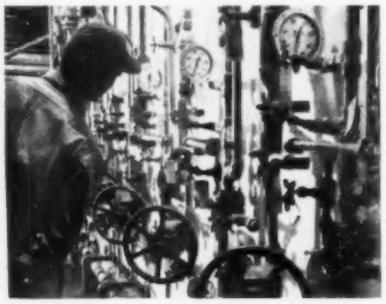
Why external recalibration is important to users of industrial thermometers

Sometimes it is necessary to recalibrate thermometers in industrial installations due to severe shock from rough handling, or to calibrate for extreme accuracy at any point on the scale for special work range.

To recalibrate the ordinary bimetal thermometer, you must remove the dial glass and move the pointer by hand. You will achieve the desired recalibration of course, but a number of undesirable things may also result. First of all, the instrument's air-tight seal is automatically destroyed in the removal of the dial glass. Secondly, in forcing the pointer, the pointer shaft may become bent or twisted.

Should the pointer shaft become bent even slightly, it can cause the pointer to stick due to improper alignment of the bimetallic shaft on its bearing surfaces. The obvious result, of course, will be inaccurate readings and necessary repair or replacement of the instrument. *None* of these things can happen with the RMC external recalibration device.

A simple dial-reset screw, located on the back side of RMC industrial thermometers, permits recalibration without opening the instrument in any way. This external recalibration feature is *exclusive* with RMC, along with true dry-air hermetic sealing.

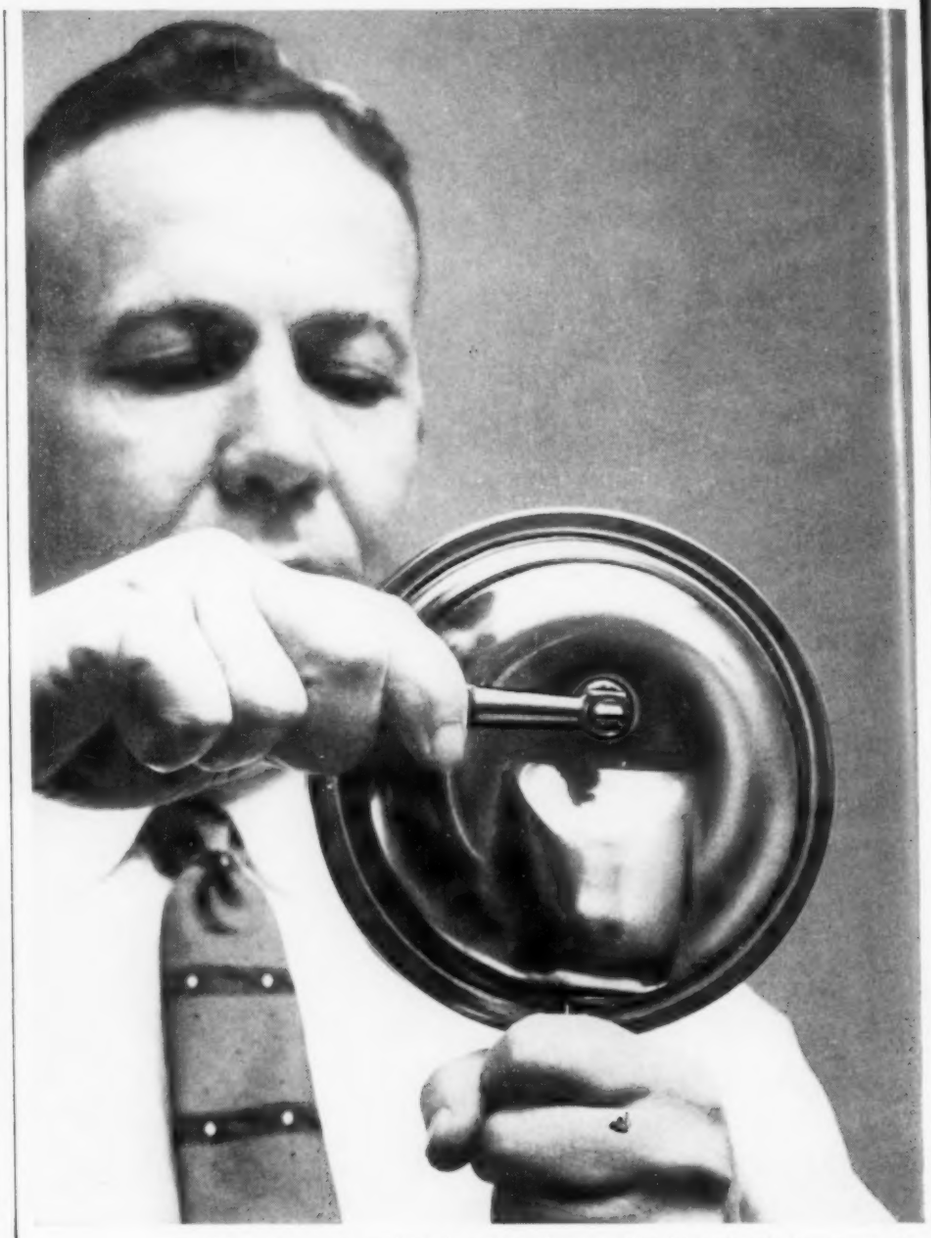


SHIPPINGPORT, Pa.—Heavy-duty dial thermometers play an important role in the operation of the world's first full-scale atomic-electric generating station devoted exclusively to civilian needs. These thermometers, manufactured by RMC, can be recalibrated externally. The plant is a joint project of Westinghouse Electric Corporation, Atomic Energy Commission and Duquesne Light Company of Pittsburgh.

RMC high pressure gauge, developed for missiles, now available to industry

RMC-LINDSAY PRESSUREGAUGES indicate pressures in ranges 0 to 1,000 psi., up to 0 to 15,000 psi., with retard scales available. Multiple coil, helical Bourdon tube type, with pointer attached direct—no linkages or pivots. Can withstand extreme shock, vibration, temperature, or overpressure and maintain consistent accuracy.

Write, wire or phone—tell us your requirements for indicating instruments, and let RMC engineering skill go to work for you. ROCHESTER MFG. CO., 207 Rockwood St., Rochester 10, N. Y.



This maintenance engineer is recalibrating an RMC bimetal dial thermometer by means of the exclusive RMC *external* dial reset screw—a simple on-the-job operation with RMC thermometers.

RMC external recalibration device saves thermometer's hermetic seal

With this *external* dial reset screw you can recalibrate your RMC thermometer easily and safely, should it ever be necessary. The all-important hermetic seal cannot be destroyed and there is no chance for damage to the critical pointer shaft. You get the *only* bimetal industrial thermometer that provides for *external* recalibration when you specify RMC.

RMC

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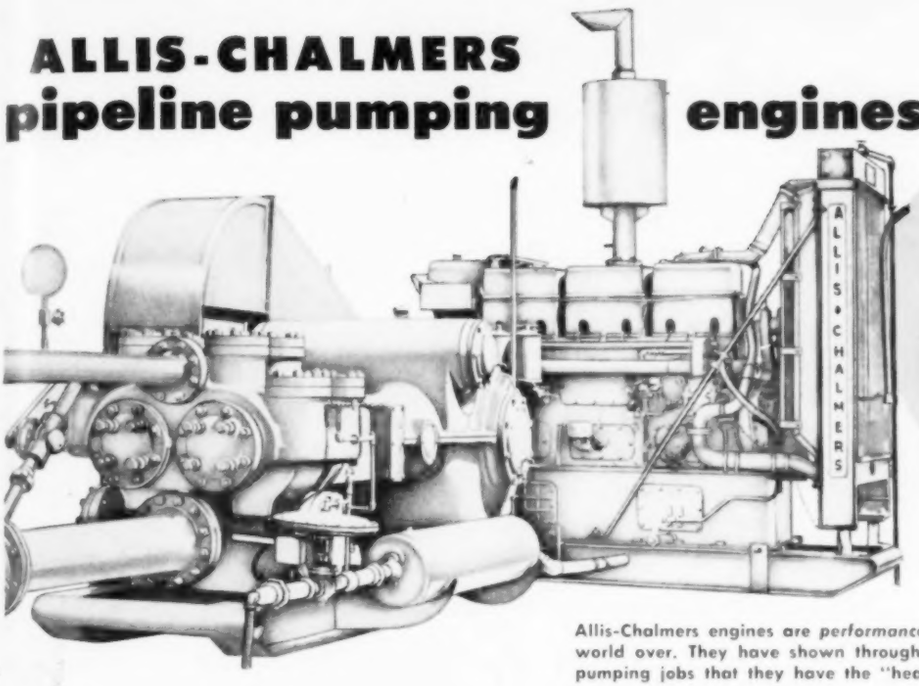
LIQUID LEVEL, TEMPERATURE and PRESSURE INSTRUMENTS

REPRESENTATIVES IN ALL PRINCIPAL CITIES

ALLIS-CHALMERS pipeline pumping engines

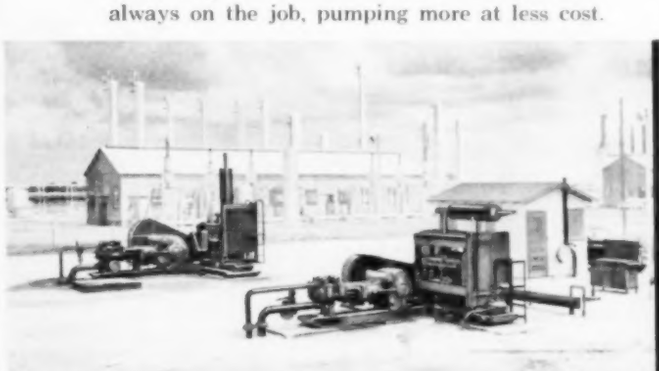


have the HEART to take it!

Allis-Chalmers engines are *performance proven* for pipeline pumping the world over. They have shown through years of service on thousands of pumping jobs that they have the "heart" for this rugged, 24-hour duty.

Maximum pumping per operating dollar — Allis-Chalmers engines have efficient combustion that squeezes the last bit of energy from every bit of fuel. These two engines are always on the job, pumping more at less cost.

Reserve power is engineered into Allis-Chalmers engines, allowing these 8PC 2505's to step up output without danger of overloading. Up to 23% more power is available at normal operating speeds for increased pumping.



Rugged construction, with design simplicity, means there is less wear, less that can go wrong. The operator of these 159-hp Allis-Chalmers diesels *knows* they can be depended upon without costly loss of time.

Moneysaving maintenance — Design simplicity means easier servicing, too. And Allis-Chalmers engines are back to work faster because they are close to fast parts and service, wherever they are.

Let your Allis-Chalmers dealer tell you more about these engines with the "heart" to take it — 9 to 516 hp, any fuel. Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

BO-8

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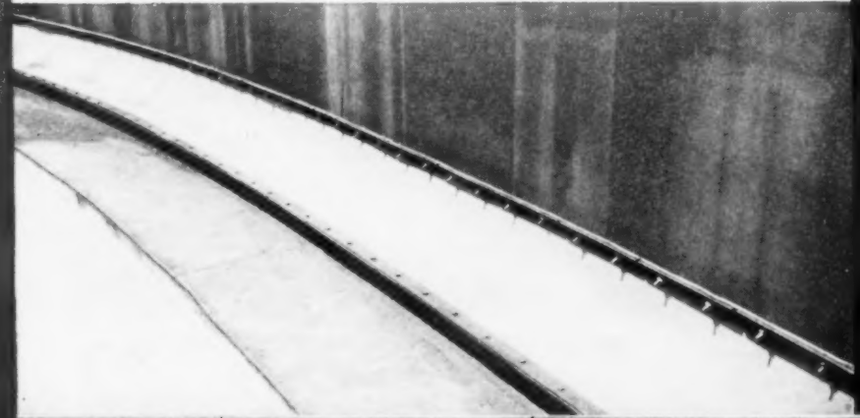
FLOATING ROOF TANKS

Offer You

MAXIMUM
SEAL PROTECTION
MINIMUM
MAINTENANCE

NOOTER is fully experienced in the fabrication and erection of double deck, pontoon and pan type floating roofs—all with the patented Nooter Seal. The Nooter design means better protection for your product because of the more efficient seal . . . minimum maintenance because there is no direct contact with the sealing ring, therefore minimum wear . . . and minimum delay in construction because easier installation and alignment are made possible by the new seal design. These advantages mean a better floating roof tank at a lower cost.



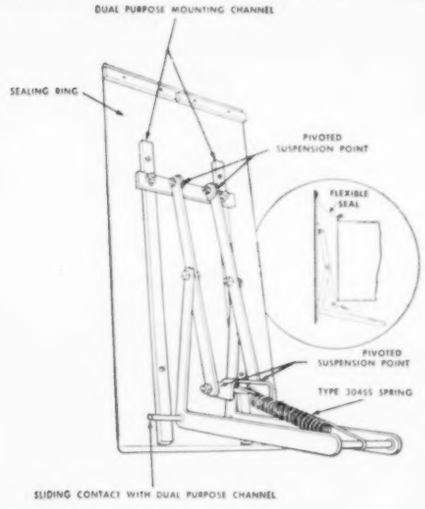
you can also update your old tanks with the new NOOTER SEAL

The Nooter Seal is readily adaptable to any existing welded or riveted tank. Requires minimum modifications for fast, easy installation.

For your next floating roof tank, or seal replacement, send your inquiries to Nooter. You'll find Nooter quality and dependable deliveries your best equipment investment.

Catalog 158 on Nooter Floating Roof Tanks is yours for the asking.

This Patented NOOTER SEAL HANGER is One Reason Why!



This exclusive Nooter 2-Point suspension seal hanger has one pivoted and one sliding point of contact with the dual-purpose mounting channel. This channel serves (1) as a means of attaching seal hanger to shoe without direct contact of seal hanger to shoe, and (2) as a method of providing even distribution of the forces of seal hanger over entire height of shoe.

NOOTER CORPORATION

"Since 1896"

Steel and Alloy Plate Fabricators and Erectors..."Boilermakers"

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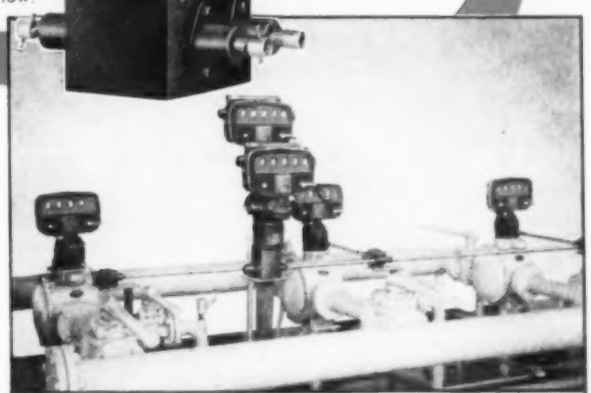
BRODIE

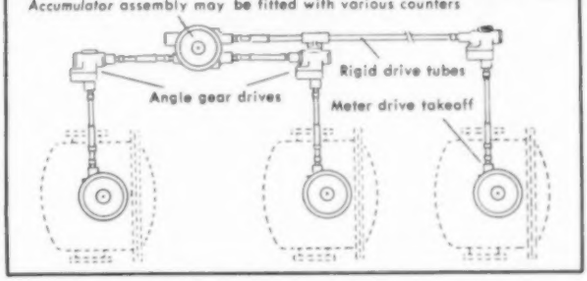
ACCUMULATOR SYSTEM

Registers combined thruput of two or more *BiRotor* Meters

Brodie *Accumulator* Assembly shown with Dual Counter Adaptor and *Brodimatic* Printing Counters. By shifting from one counter to the other, separate records may be kept on each tender without stopping meters or flow.



Accumulator assembly may be fitted with various counters



Schematic layout illustrates typical three-meter installation in photo. *Meters need not be of same capacity.* Accumulator and angle gear drives are friction-free ball-bearing mounted.

- **Positive mechanical drives from separate meters feed information into a simple low-friction *Accumulator* gear assembly to drive common counter equipment**
- **Simplifies accurate accounting by providing total thruput readings**
- **Provides for future increased line capacity by addition of meters without disturbing original equipment**
- **Gives individual readings on gathering lines, plus total input to main line**

Proved through long continuous operation, the Brodie *Accumulator System* finds broad application in crude and product pipelines, custody transfer, blending, and bunkering ships. For every high-volume metering problem, investigate the *sustained accuracy* of Brodie *BiRotor* Meters plus the versatile applications of *Brodie Accumulator Systems.*

807

ALL-STEEL BiRotor TRUE-ROTARY

BRODIE METERS

RALPH N. BRODIE COMPANY • San Leandro, California, U.S.A.

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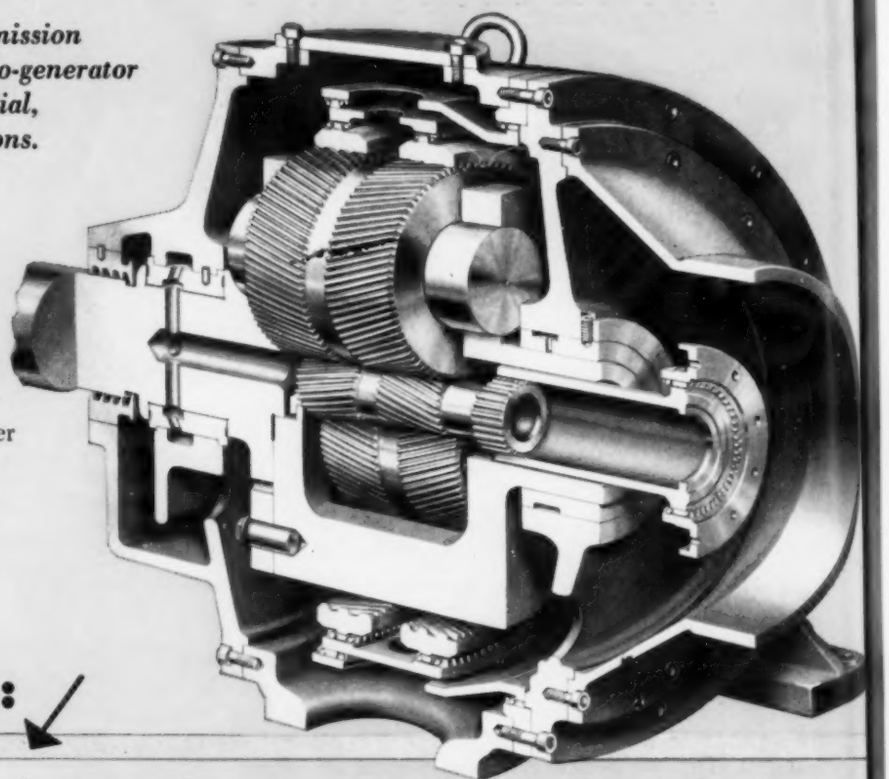
DE LAVAL-STOECKICHT
PLANETARY GEAR

...for high speeds...high horsepower

Proved in hundreds of installations abroad totalling over 3,000,000 horsepower—now available in America!

For all high torque power transmission applications such as pump turbo-generator and compressor drives in industrial, municipal and marine installations.

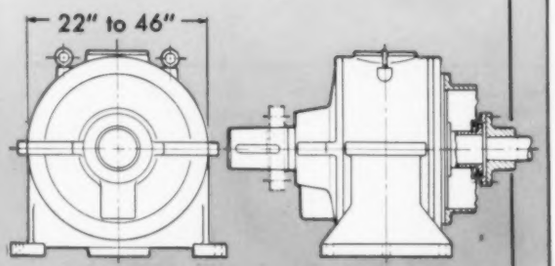
This cutaway view of the De Laval-Stoeckicht Planetary Gear shows how it provides flexibility for proper load distribution throughout the gear members. The thoroughly proved and tested design is completely reliable in transmitting high horsepower for high speed applications. • Highest efficiencies (98% or higher)... no high speed bearings... less friction losses.



Check These Advantages:

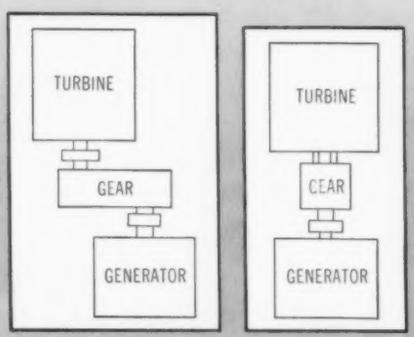
Small Size—Light Weight

Compact—low weight per hp. Sizes range from 22" to 46" in diameter, depending on horsepower requirements. Example: 5000 hp planetary unit weighs 1700 lbs. against 6000 lbs. for conventional gear.



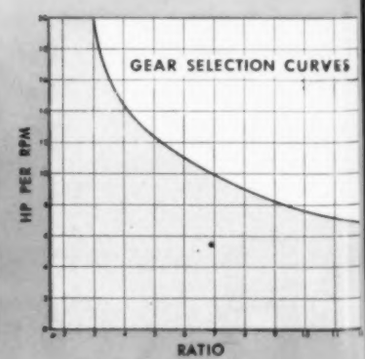
Convenient Arrangement

Co-axial or "in-line" arrangement of gear members takes up far less space than parallel axis gears of equivalent horsepower rating.



Wide Application

Capacity range shown in shaded area on chart below. For other applications, contact your De Laval Sales Engineer.



For further details, write for Bulletin 2400.

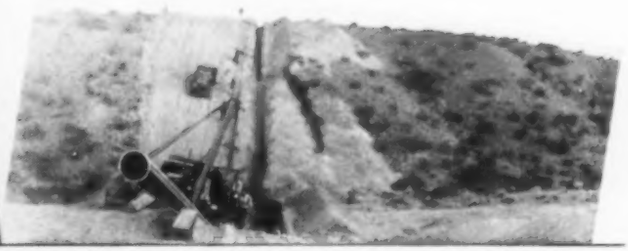
DE LAVAL *Steam Turbine Company*

884 Nottingham Way, Trenton 2, New Jersey

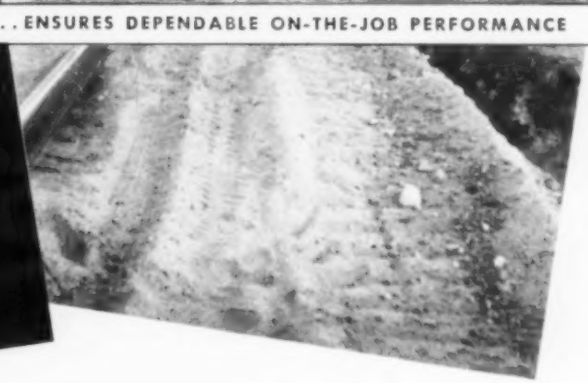
Acme-Newport Steel

YOUR FIRST CHOICE for 4" and 6" ELECTRIC WELD LINE PIPE*

73 YEARS' STEELMAKING EXPERIENCE . . .



. . . ENSURES DEPENDABLE ON-THE-JOB PERFORMANCE



The ease of installation and long trouble-free service of Acme-Newport gathering lines under the most rugged conditions are testimony to this basic steel producer's excellent combination of modern facilities, conscientious personnel and years of experience. From melting furnace to final pipe forming and testing, every operation at Acme-Newport is quality controlled to yield all those properties you demand in line pipe . . . true roundness, uniform wall thickness, ease of bending, line-up and welding. Exceeds API and ASTM specifications. Consult Acme-Newport for your needs in 4" and 6" sizes, standard or thin wall.

ECONOMICAL WATERAIL-TRUCK DELIVERY

This Company is ideally situated on the Mississippi-Ohio River system and the great Cincinnati rail-truck hub. Now barge facilities, 7 major railroads and 143 motor carriers enable Acme-Newport to give economical, dependable delivery to the entire area of the Middle West and South.

*SIZES AND WEIGHTS AVAILABLE

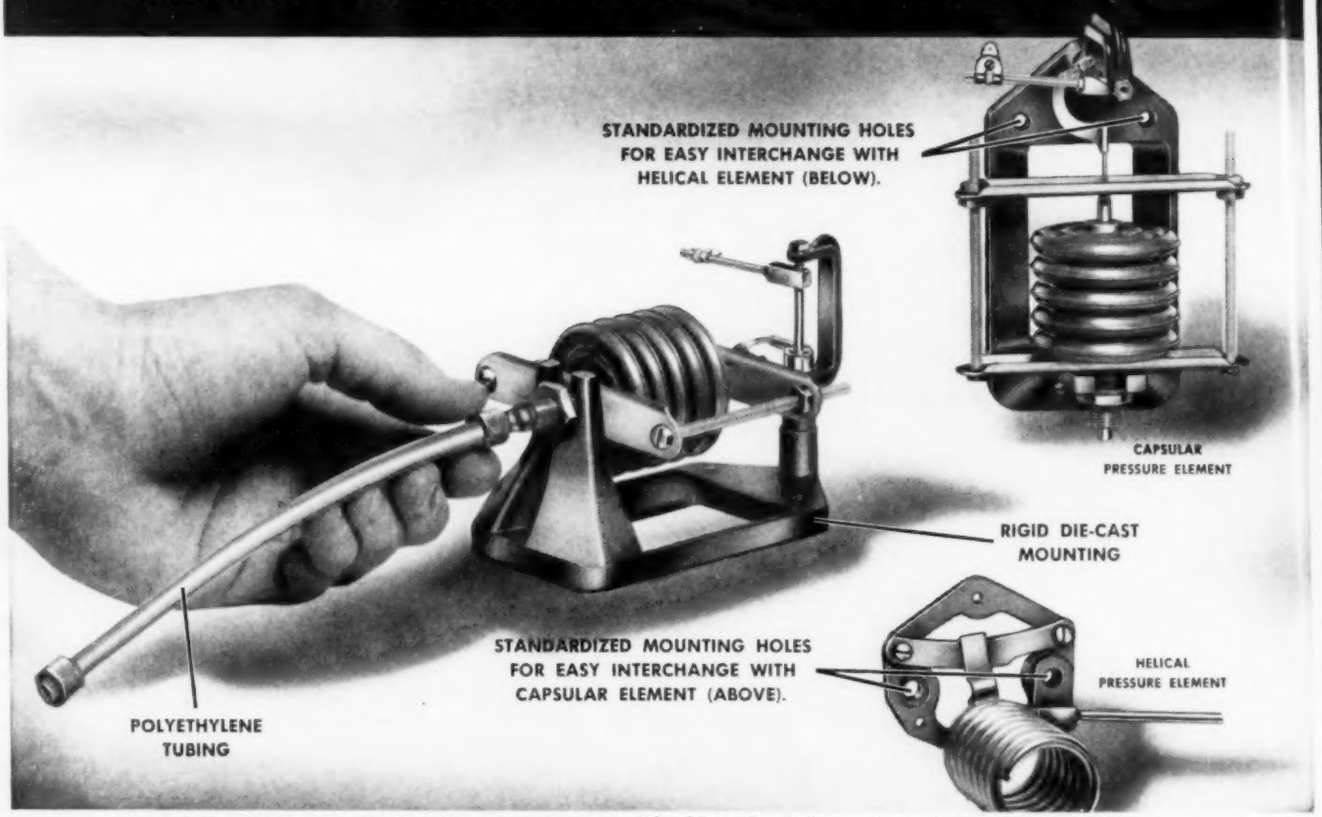
O.D.	Wall	Wt. Per Ft.
4½	.125"	5.84
	.142"	6.61
	.156"	7.25
	.188"	8.64
	.219"	10.00
	.237"	10.79
6⅝	.156"	10.78
	.188"	12.89
	.219"	14.97
	.250"	17.02
	.280"	18.97

Acme-Newport Steel COMPANY

NEWPORT, KENTUCKY

A SUBSIDIARY OF ACME STEEL COMPANY

WHAT'S NEW IN RECORDING GAUGES AT BRISTOL...


STANDARDIZED MOUNTING HOLES FOR EASY INTERCHANGE WITH HELICAL ELEMENT (BELOW).
CAPSULAR PRESSURE ELEMENT
RIGID DIE-CAST MOUNTING
STANDARDIZED MOUNTING HOLES FOR EASY INTERCHANGE WITH CAPSULAR ELEMENT (ABOVE).
HELICAL PRESSURE ELEMENT
POLYETHYLENE TUBING

RECENT BRISTOL RECORDING GAUGE DEVELOPMENTS. Flexible polyethylene tubing *(left)* and standardized element mountings simplify element interchange, provide increased mounting rigidity and vibration isolation.

Why are more Bristol Recording Gauges used than all others combined?

A key reason for this preference: *Bristol Pressure Measuring Elements.* They're the result of more than 69 years of practical experience. *And field reports show that our recording gauges, equipped with these famed measuring elements have been in constant service for up to 40 years! An outstanding record for long life and stability!*

Another reason: Our continuous development program, aimed at keeping Bristol Recording Gauges far in advance of today's needs. The latest results of this program are now available in Bristol Recording Gauges:

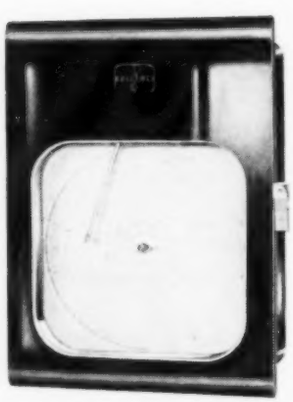
Easy-change elements. Element mountings have been redesigned to insure interchangeability of elements. You can buy a pressure gauge with any standard helical element and change later to any standard capsular type element, or *vice versa.*

Extra mounting rigidity. Rigid cast-aluminum element mounting gives you greater accuracy, stability and reliability.

Flexible polyethylene tubing used to connect measuring elements. Simplifies interchange of elements, simplifies maintenance. Isolates element from shock and vibration.

Improved element materials. Capsular measuring elements are now available in **316 stainless steel and Ni-Span C,** as well as phosphor bronze. As a result, this type of measuring element, ideal for low pressures, can now be used for a large number of corrosive fluids. Helical elements are now available in **316 stainless steel and Ni-Span C, too,** as well as trumpet metal and beryllium copper.

Find out more about these latest Bristol gauges for recording, automatic control, pneumatic transmission and telemetering. Send for our 32-page catalog G621, today. The Bristol Company, 114 Bristol Road, Waterbury 20, Conn. B.24



BIG REASON FOR USER PREFERENCE is Bristol measuring elements, unexcelled for accuracy, precision, long-term stability. **They're made in ranges from 0-6mm mercury absolute to 0-10,000 psi.**

BRISTOL

TRAIL-BLAZERS IN PROCESS AUTOMATION

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

FIRST LINE OF DEFENSE

against internal pipeline corrosion

KONTOL 77 corrosion inhibitor

stands as the No. 1 enemy of corrosion in thousands of miles of pipe line all over the world—fighting off corrosion, scaling, fouling and their simultaneous problems of friction loss and decreased throughput.

KONTOL-clean lines require less frequent scrapings and eliminate the need for higher pump pressures (and higher maintenance costs) in order to maintain pumping efficiency. The use of Kontol 77 eliminates contamination and discoloration caused by the products of corrosion.

HERE'S DRAMATIC PROOF OF KONTOL 77 EFFECTIVENESS

BEFORE KONTOL 77. This untreated, corrosion-clogged pipe shows heavy "moss" growth and scaling.

AFTER KONTOL 77. The smooth interior surface of this Kontol-treated pipe means improved "C" factor, restored throughput.

KPL-58-3

Have your Kontol Service Engineer (the Man in the Tretolite Car) tell you the rest of the KONTOL story. It makes dollars—and sense!

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For more data on advertised products, use Readers' Service Cards, last page.

DURIRON

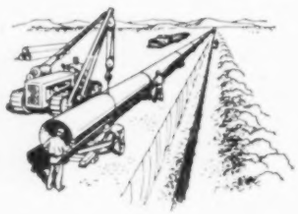
ANODE DATA SHEET

Number 2

Ground Bed

Basic engineering information about DURIRON *impressed current anodes for cathodic protection.*

Protection of a Pipe Line



THE PROBLEM: To protect a pipe line in a creek bed area where coke breeze could not be used due to sandy top soil and quicksand at a four foot depth. The very nature of sandy soil prevents adequate backfilling because it is very prone to caving. The original ground bed of bare scrap iron anodes had a high resistance and showed a tendency to dry out during the year. Adequate protection of the pipe line was not being achieved.

THE INSTALLATION: Twenty Duriron Type D Anodes (2″ dia. x 60″) were installed in two rows, 20 feet apart, with 20 foot spacing in each row as illustrated in Fig. 1. Soil resistivity averaged 2500 ohm-centimeters measured with the four pin method at 10 foot spacing. The anodes were jetted into place using a high velocity stream of water through a 10 foot piece of 1 inch pipe with the top of each anode eventually being approximately three feet below the surface (Fig. 2). Approximately 60 seconds were required to install each anode by this method. The anodes were connected to a 2/0 aluminum header, with the exception of numbers 4, 6, 16, and 17 which were connected to separate number 6 leads and were carried back to the rectifier and connected thereto with 0.01 ohm Holloway shunts. This made possible the reading of individual current values for these four anodes. The connection to the pipe line was by means of an overhead 4/0 copper cable, a distance of about 1000 feet.

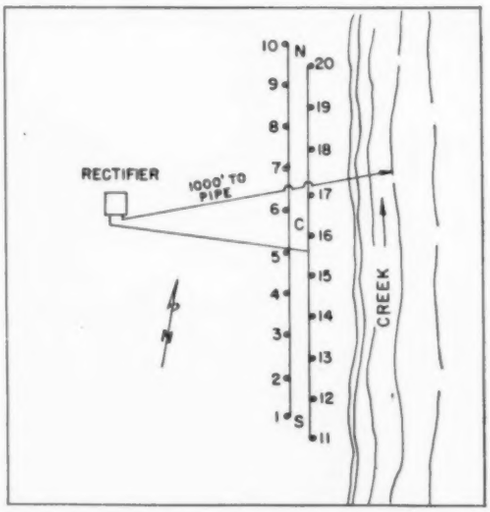


FIG. 1—Illustration of how Duriron Anodes were spaced.

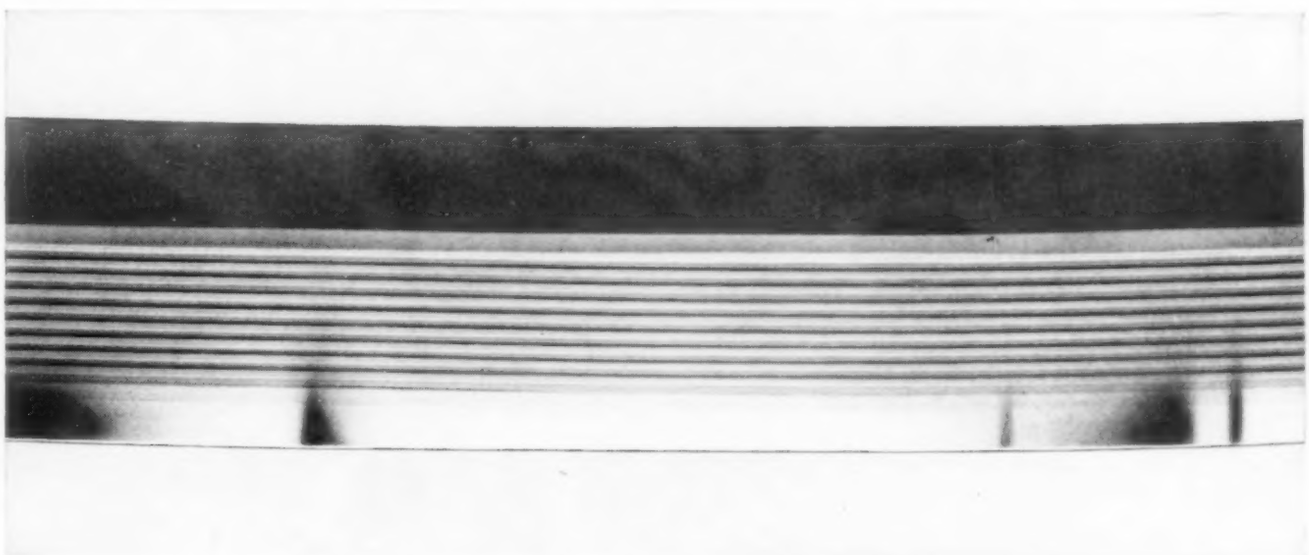
THE PERFORMANCE TO DATE: This group of anodes produced 34 amperes (an average of 0.65 amp./sq. ft.) at 46 volts, and after approximately three year's time, these readings have not fluctuated appreciably. Based on initial readings, the resistance of single Type D anodes to ground is approximated by the expression $R=0.005\rho$. (R is the single anode resistance and ρ the soil resistivity in ohm-centimeters.) The loop resistance of sixteen anodes (all except the four with independent leads) was measured as 1.3 ohms; the four, together, read 3.9 ohms; and all twenty indicated 1.2 ohms. This indicates that Duriron anodes can be installed without backfill and operate at appreciable current densities with no noticeable tendency toward gas blocking. The jetting-in process used to install these Duriron anodes was reported to result in considerable savings. It would have been very difficult to install anodes in holes dug by the usual rotary drill method under the ground conditions described above, and it would also have been expensive to transport backfill to this relatively inaccessible locality.

FIG. 2—Illustration of jetting in process.

THE DURIRON COMPANY, INC./ Dayton 1, Ohio

Reduce break-in time by as much as 80%!

with factory pre-seated full chrome PEDRICK PISTON RINGS



Bright highlight along lower face of ring shows area pre-seated by factory lapping.

Use of PEDRICK Chrome Piston Rings reduces break-in time by as much as 80% . . . allows the engine to be put under full load very quickly. This is because PEDRICK laps or pre-seats its Chrome Rings to cylinder size *at the factory*. PEDRICK Chrome Rings are the most modern twist-seal and/or taper face designs, which further speeds seating and helps provide a quick, positive seal.

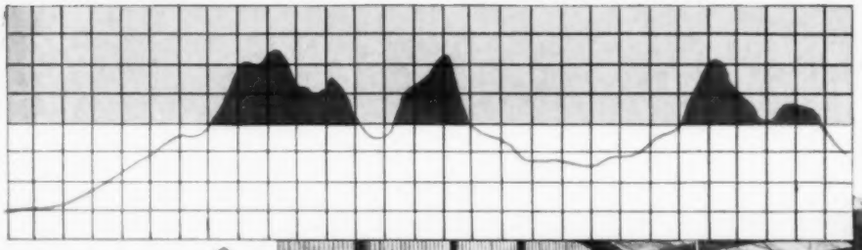
All PEDRICK Chrome Rings have a full Chrome coating. Chrome coating on a PEDRICK Ring is never less than .006 inches and may be as much as .010 or .012 inches thick depending upon the size of the ring and the use for which it is intended. On PEDRICK Chrome Rings, thickness of the Chrome coating is measured *after* the lapping operation.

PEDRICK Full Chrome Rings resist scuffing, withstand high temperatures, abrasion and corrosion.

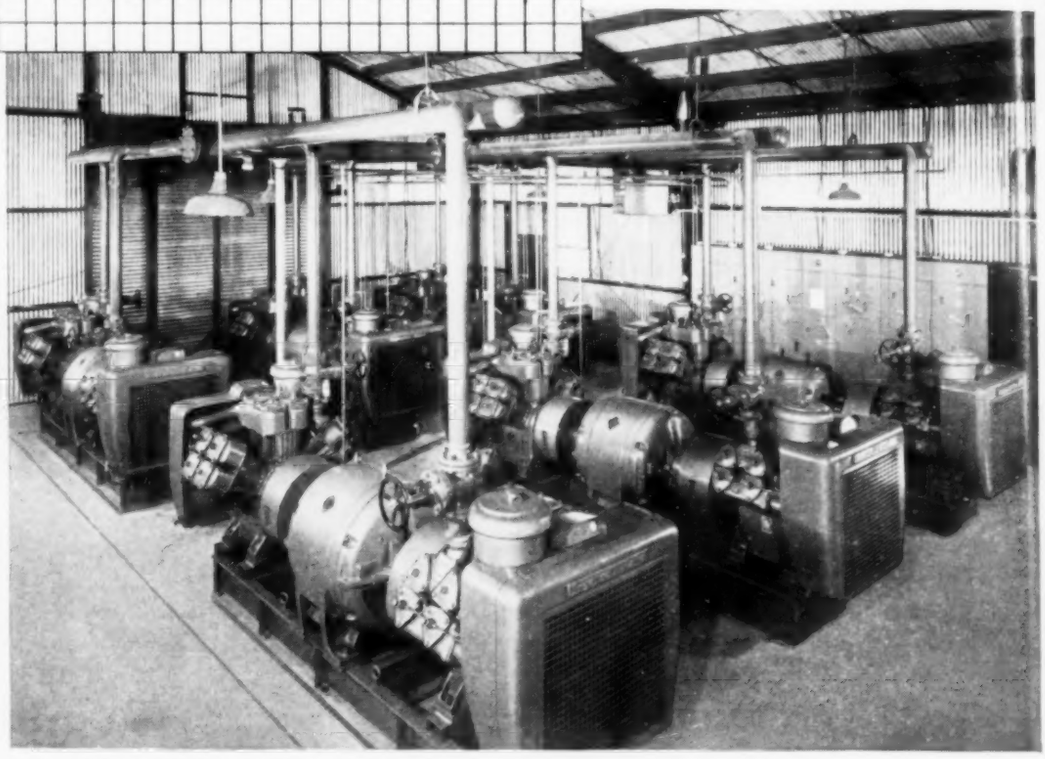
Include PEDRICK top Chrome Rings in your replacement ring sets and increase ring life by as much as four times. A PEDRICK engineer will be glad to call and help you solve any special problems. Write, wire or phone: WILKENING MANUFACTURING CO., Philadelphia 42, Pa., SAratoga 9-3770.

Pedrick PISTON RINGS

PEDRICK PIONEERED CONFORMABLE PISTON RINGS FOR BIG-BORE ENGINES



Whenever daily or seasonal load peaks exceed the capacity of its natural gas pipeline, Iowa Power and Light Co. meets the extra demand with its own propane-air mixing plant.



These six 250-hp twin-mounted Ingersoll-Rand Type 40 compressors deliver 125-psi air to the propane-air mixer. Note the wide flexibility of production made possible by this number of double units.

How Iowa Power & Light Company

SHAVES GAS LOAD PEAKS

with a 1500-hp assist from Ingersoll-Rand air-cooled compressors

"Peak shaving" is a big money saver—to both the consumer and the supplier. By providing reserve capacity to meet load peaks, it avoids high pipeline demand rates or costly construction for additional pipeline capacity.

The Iowa Power and Light Company has solved this problem very efficiently at its Des Moines station, by the addition of a propane-air mixing plant which can produce more than 18 million cubic feet per day. Designed and built by Draketown (Drake and Townsend, Inc.), this plant produces a mixture of 54 percent propane and 46 percent air; the resultant mixture has approximately the same physical properties as 1000-btu natural gas, but has a higher heat value (1350 btu).

Air for the mixing plant is provided by six double-mounted Ingersoll-Rand Type 40 compressors, each consisting of two 125-hp units coupled to a single 250-hp motor between them. These air-cooled compressors were selected due to their low space requirement and the flexibility inherent to such a combination. The installation has a total capacity of 6600 cfm—enough to produce 18,700,000 cubic feet of gas mixture per day to the distribution lines.

Type 40 compressors are completely self-contained, two-stage air-cooled units. They are available from 25 to 125 hp with flange-mounted, coupled or belted motor drive. For more information on these and other Ingersoll-Rand compressors, call your I-R representative or write direct.

Only I-R compressors have CHANNEL VALVES
Known for high efficiency, quiet operation and exceptional durability. Entirely different. Each valve is a combination of straight-lifting stainless-steel channels and leaf springs, with trapped-air spaces which cushion action, prevent impact.

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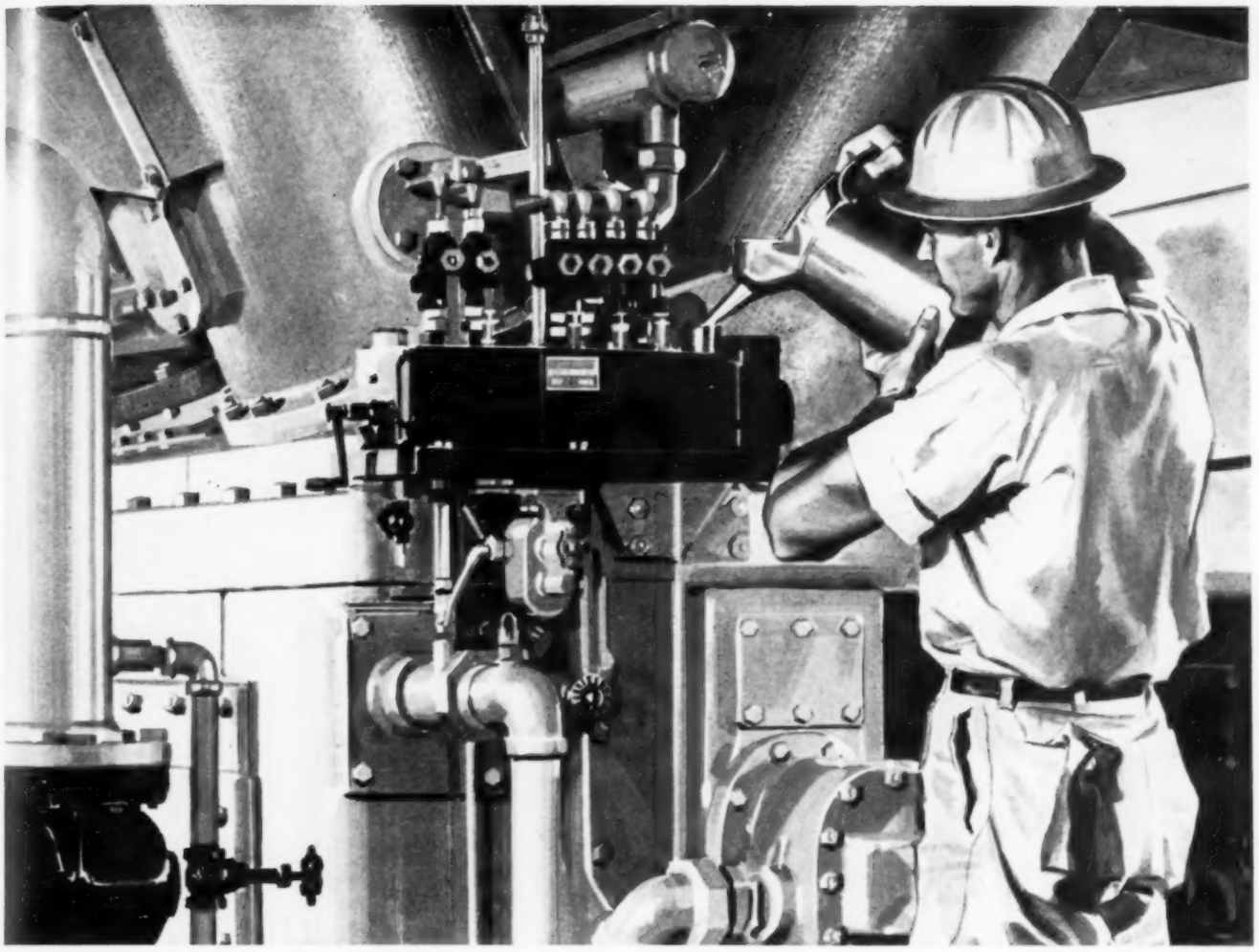

Humble lubricants

increase operating efficiency — extend engine life

Humble industrial engine lubricants minimize engine deposits and reduce friction wear, allowing your engines to maintain peak operating efficiency. Humble provides a lubricant of exceptional quality for the most demanding lubrication requirements of every industrial engine, regardless of engine type or make.*

At your request, one of Humble's trained lubrication engineers will make a study of your lubrication problems and give you specific recommendations for their solution. This service is without cost or obligation.

**And for your grease requirements, we recommend Humble's remarkable new NEBULA® EP 1, a multi-purpose, extreme-pressure grease with constant consistency-temperature properties.*

• *For complete information on Humble industrial engine lubricants see your Humble salesman, or phone or write:*

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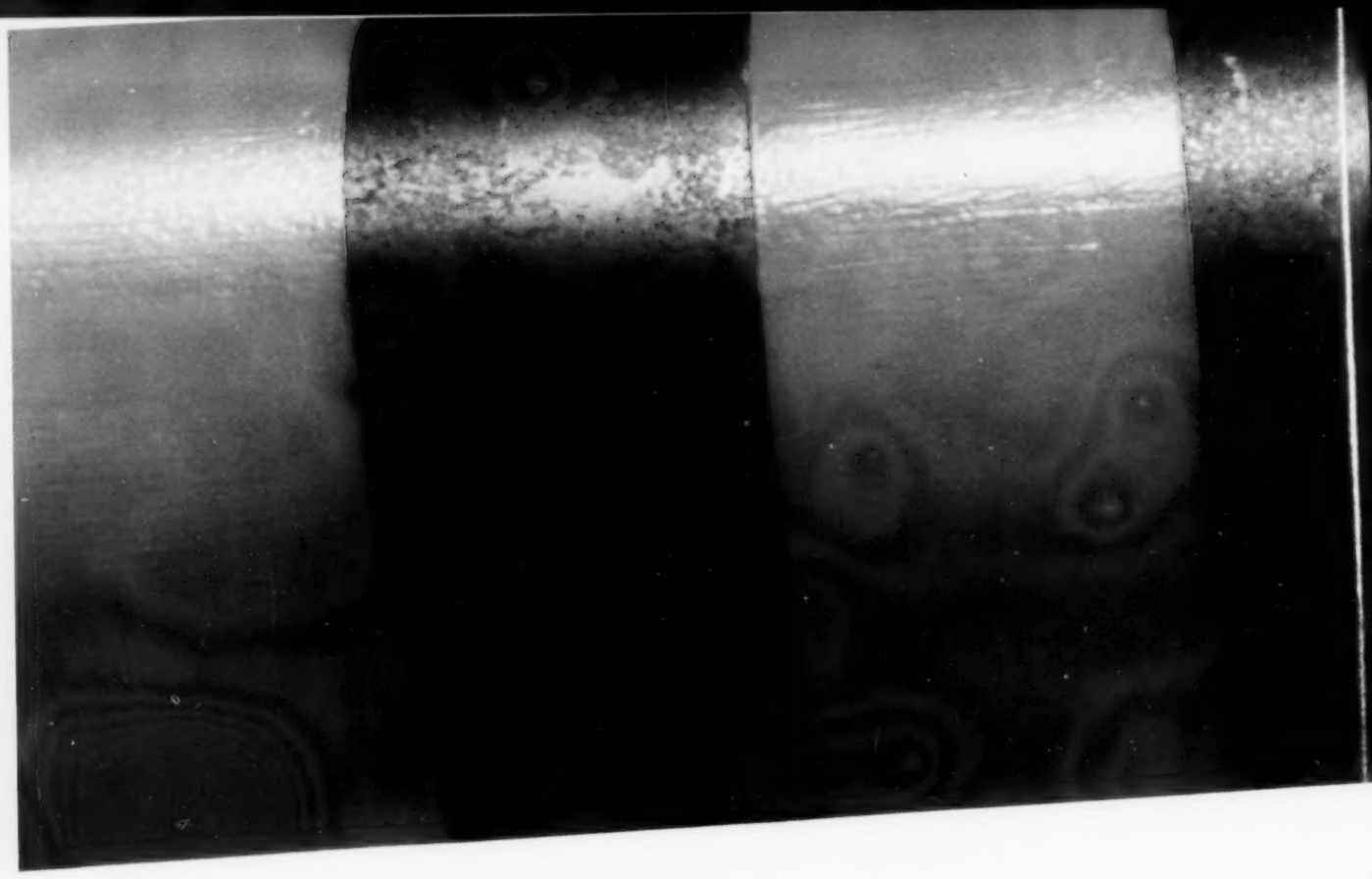
Sales Technical Service
P. O. Box 2180
Houston 1, Texas

HUMBLE OIL & REFINING COMPANY **HUMBLE**



WHEREVER YOU FIND PIPE WITH ORANGE BANDS YOU'LL FIND A SMART PIPE BUYER

Youngstown's Oil Field Service Corps—nine qualified engineers—stand ready around-the-clock to consult on all your drilling problems. These professional men have offices in the oil fields and will gladly lend you their knowledge and long experience—either prior to drilling or during actual operations. They can tell you, too, about the pipe with the orange bands, the finest seamless pipe made anywhere. Call your nearest Youngstown District Office, today.

THE YOUNGSTOWN SHEET AND TUBE COMPANY
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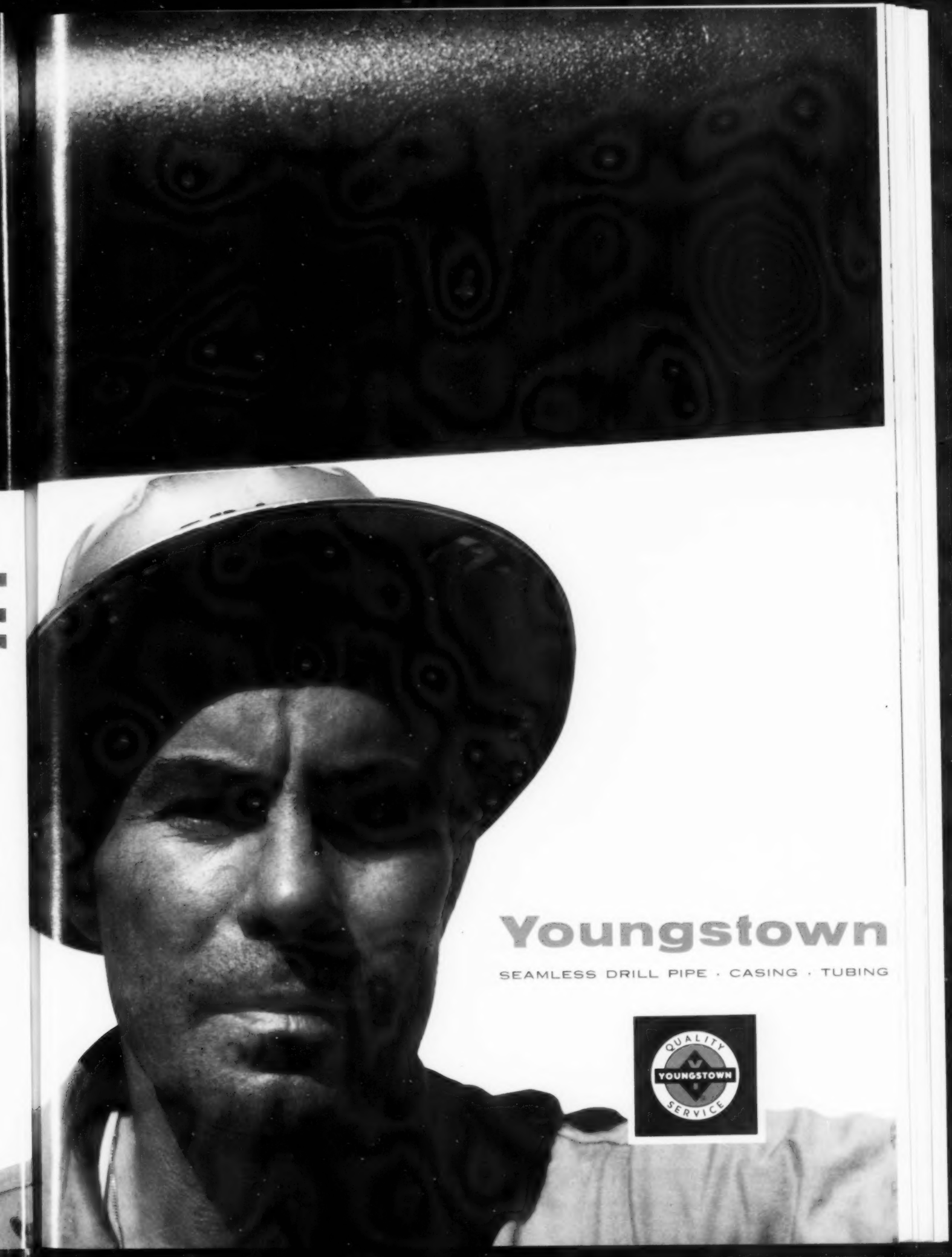

Youngstown
SEAMLESS DRILL PIPE · CASING · TUBING
QUALITY
YOUNGSTOWN
SERVICE

C. E. Williams, Gulf Sales Engineer, Midland, Texas, and G. W. Ramsey, Ass.stant Plant Superintendent, inspect force feed lubricators on one of the modern gas engines at the Goldsmith plant of El Paso Natural Gas Company.

No lubrication problems in 8 years of operation

Since 1949, twenty-seven gas engine-compressor units developing 39,985 horsepower at the Goldsmith plant of El Paso Natural Gas Company have been thriving on Gulf Security Oil. Bearing, ring and cylinder wear maintenance records have been excellent.

Insure safe, more effective lubrication protection for *your* compressor units. Specify Gulf Security . . . the high quality, straight mineral oil. For full information, call your nearest Gulf office.

GULF ®

GULF OIL CORPORATION, Dept. DM, Gulf Building, Pittsburgh 30, Pa.

PIPE LINE PANORAMA

No Signs of Recession Here . . . In contrast to bleak '57-'58 fiscal earnings of oil companies, natural gas transmission annual reports show healthy increases: Tennessee Gas' 12-month net income on June 30 totaled $45 million, compared with $32 million in '56-'57 fiscal year—also, April-June gas deliveries were 9 percent over '57 second quarter. Texas Eastern's net income increased from $19 million to $27 million. Transcontinental's net increased from $13 million to $16 million.

Construction to Pick Up in Second Half . . . American Gas Association predicts that despite slow start in first half, gas transmission construction outlays in the U. S. will jump to $918 million during '58, compared with $753 million last year. In '59, outlays are expected to total about $693 million.

Although construction will increase in second half of '58, total mileage will fall short of 6,300 miles added to U. S. gas transmission network during '57.

What's Happening in Construction . . . In mid-August, Texas Eastern dedicated its Lebanon, Ohio Little Big Inch products terminal, opening the first pipe line link between Gulf Coast refineries and Midwest consuming areas. Company officials are giving top priority plans that will extend the Little Big Inch products system to the East Coast.

El Paso Natural Gas has announced plans to build 400-mile, 34-inch gas line from Salt Lake City to California border. Line will connect with 140-mile line Colorado Interstate plans to build from Rock Springs, Wyoming to Salt Lake City. El Paso will purchase 200 million cubic feet of gas per day from Colorado Interstate and another 200 million from Pacific Northwest—will also build $26 million plant in Utah's San Juan County to extract natural gas liquids from Four Corners production.

Service Pipe Line Runs New Variable-Diameter Scraper . . . Researchers for Service Pipe Line say new Big Inch variable-diameter scraper has proved its worth in initial tests. It is larger (will service lines varying from 18 to 24 inches in diameter, compared with previous 12-16 inch range)—also makes it possible to "pig" lines of various diameter pipe without requiring scraper traps at junctions. (See Page 45).

New Way to Determine Line Pack . . . Panhandle Eastern has provided its dispatchers with a simpler, faster way to determine line pack in its pipe lines. New method: Simple analog computer called "Packometer" which uses the circuitry as an electrical analog for the equation. Instrument can determine actual line pack—also differential of pack when it is changing. Company spokesmen say "Packometer" eliminates time consuming mathematics and need for nomographs.

Washington Panorama . . . Service, Tidal and Arapahoe pipe line companies will challenge Justice Department appeal of Federal District Court decision which upheld companies' dividend payment practices. The decision, involving charges that 53 pipe line companies and 36 company owners violated 1941 Elkins consent decree, has been appealed to District of Columbia Court of Appeals and the Supreme Court . . . **Pressure is mounting to have Eisenhower cut voluntary imports of crude** back to 1954 levels. Complete revamping of the imports program may be in the offing, including restriction of products under new Trade Act . . . **After talking one gas bill** to death, forces are being gathered to introduce another in next session of Congress.

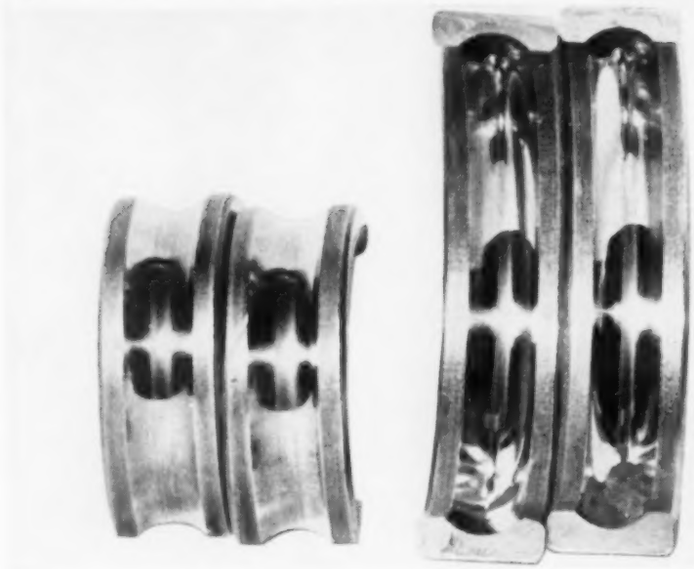


FIGURE 1—Ball path in highly polished races of a bearing that has operated under balanced radial load shows a dulled surface. It appears similar to a lapped surface where fine grinding scratches had been smoothed out. Although appearance of the surface balls or raceways might be dull, there has been no appreciable removal of material.

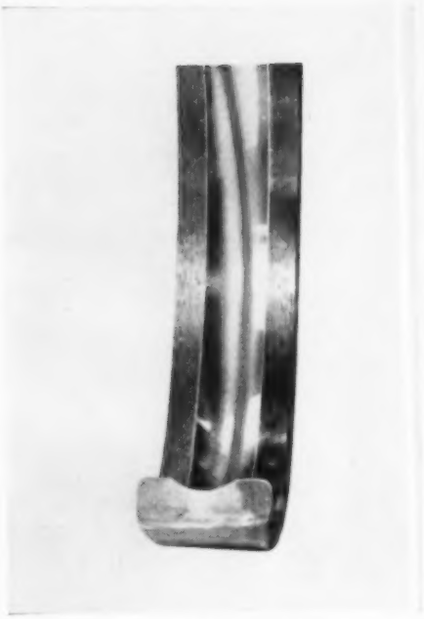


FIGURE 2—A winding ball path may be a good indication that a supporting shaft shoulder has wallowed out of contour. This leaves inner race tilted on the shaft.

Part 1—Check List for Maintenance
Part 2—Influence of Design Factors

Lengthen the Life of Antifriction Bearings

This guide can help you locate quickly those causes of common bearing troubles. Careful preventive maintenance will eliminate most of them.

By Johnny Riddle
Allied Bearing Supply Company, Tulsa

Of all the mechanical devices that serve vital functions in pipe line equipment, probably none repay good maintenance practices better than do ball and roller bearings. A great deal of helpful literature on bearing service procedures has been published in the past few years; still, field observations point to the fact that maximum bearing life is seldom realized.

Equipment service life could be profitably extended in many instances simply by attention to basic maintenance recommendations. Needless bearing failures can be extremely costly; it should be the object of conscientious field and station personnel to keep them to an absolute minimum.

Obviously, the ideal surroundings for a bearing change-out would be an air-conditioned workshop equipped with hydraulic pulling equipment and a supply of clean shop rags nearby. But for men whose work is performed under field conditions, or at best in an improvised work area, these surroundings simply do not exist. Nevertheless, a great many details may be attended to thoughtfully.

Cleanliness First. Dirt is the greatest enemy of good bearing performance; every possible safeguard should be taken to see that the new bearing reaches the point of final installation in a clean condition. Field conditions are not ideal, but efforts to keep bearings clean will pay large dividends.

Lubricant Recommendations. A rule-of-thumb specification for bearing lubrication does not exist, and any such claim may properly be termed invalid. Machines and equipment operate on too wide a range, under too many conditions, to permit the establishment of a set of inflexible instructions.

Different greases and oils have different properties. A grease pack may resist, or retard, the tendency to deteriorate in wet or moist conditions. Also, greases are intended for different thermal conditions. These and literally scores of other factors must be evaluated before lubricants are selected.

Lacking more specific instructions, the equipment operator should give careful consideration to the recommendations drawn up by the equipment manufacturer. It is likely that his final decision to use a particular oil or grease was the result of long and exhaustive research. Perhaps he was assisted by bearing engineers and lubricant specialists. Low and high temperatures (ambient and operating), presence of contaminants, bear-

FIGURE 3—Overloading will cause a breaking out of the surface layer of steel. Such failures may start out in a small area, but then spread rapidly.

ing speeds and loads, entry of water or moisture, accessibility of equipment for periodic replenishment—these and many other factors were carefully studied.

How much lubricant? Again, this is and remains an indeterminate. The penalty when too much lubricant is present—overheating; and the penalties for inadequate amounts are well known too.

Ordinarily, a bearing chamber should not be filled beyond one-third capacity when grease is used. Oil, when used as a bath or pool, should not be higher than the centerline of the lowest ball or roller. Such quantities are normally adequate for lubrication, and they prevent dangerous over-heating.

There may be, of course, instances when the equipment builder recommends a completely full grease chamber—this is occasionally resorted to in slow speed mountings when maximum seal efficiency is required. These are exceptions, however, and the equipment builder's charts should be followed.

Mounting. Just prior to actual mounting, there are a number of measures which merit attention:

- Check for, and remove, all nicks, burrs and extrusions from shaft and housing.
- Remove all foreign materials from these members.
- Never expose bearings until ready to install.
- Use an arbor press for mounting when one is available; use the drift method—close-fitting pipe length and hammer—as a second choice.
- Larger bearings may be oil- or oven-heated to facilitate mounting. This method reduces the manual exertion otherwise associated with the mounting of large and heavy bearings. Use clean oil for the bath, and do not over-heat, 150°F. or slightly more is sufficient and does no harm. Ovens, when used, should be properly regulated.
- Start the bearing on the shaft squarely. Apply pressure against inner ring when mounting on shaft, against outer ring when pressing into the housing. Oil-heated bearings sometimes show a tendency to back off from the locating shoulders as they cool. Guard against this.

Bearing removal is essentially a reversal of the above steps, except that pulling devices take the place of pressing equipment. Even so, removal procedures merit the closest care and attention.

Watch Bearing Specifications. When ordering replacements, give full details regarding bearing number and machine on which they are to be used. Nomenclature symbols are critically related to bearing internal design. They pertain to such things as cage properties and design, intentional radial and axial clearances subsequently reduced by normal mounting fits, and, in the case of some pump bearings, to built-in preload.

When in doubt on a maintenance problem, it is good practice to consult either the equipment builder or a bearing technician. Bearing manufacturers also maintain a service department for this purpose.

Failures and Their Causes. In a very general sense, the expected life span of a given ball or roller bearing is so many stress cycles; this in turn is affected by both the intensity and frequency of the stresses applied. Compressive stresses may go very high, often beyond 250,000 psi. Obviously, any irregularity in loading can damage the bearing surfaces; of course, it is assumed that a unit is properly installed, well lubricated and effectively sealed.

But other difficulties do develop. Mounting is often attended by negligence. Shafts or housings may be irregularly formed, off-square and out-of-line. They may also become damaged in service. Load conditions not anticipated may momentarily develop. Vibration may enter the machine assembly. For one or more reasons, dangerous over-heating may appear. These and a score of similar difficulties may develop from time to time. Any one of them can shorten bearing life as much as 90 percent or more.

When such problems appear, it is important to investigate and deter-

FIGURE 4—Here is a graphic comparison that shows the results of negligence during bearing installation. The bearing on the left has already started to take on the dulled polished appearance caused by abrasive wear from dirt or abrasive contaminants that got into the bearing during installation. As wear increases, heavy and irregular loads are then shifted to other machine parts. The unit on the right has retained its original surface gloss.

FIGURE 5—Lubricant oxidation causes heavy sludge deposits. These gummy materials take up vital lubricant space and retard dissipation of heat generated during operation. They also interfere with necessary roll-cage freedom and intensify compressive stresses on balls or rollers.

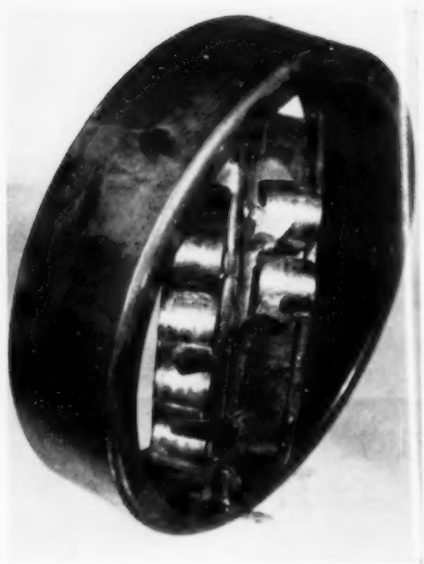


FIGURE 6—Extreme overheating will cause complete destruction of bearings. Cause may be excessive loads, poor alignment, failure of lubricant or external heat.

mine the cause. Very fortunately, failures often leave clearly defined markings; several are shown in accompanying photographs.

Proper Mounting and Maintenance. A bearing that has operated under balanced radial load can be identified by its markings, one is shown in Figure 1. The path of the balls in the highly polished races shows a dulled surface similar to a lapped surface wherein the microscopically fine grinding scratches have been smoothed out. There has been no appreciable removal of material from the surface, as indicated by the fact that there has been no measurable decrease in the diameter of the balls, though their surface is dull. When the nature of load is one of pure thrust, the ball paths will appear well to one side of bottom-dead-center.

Improper Line-Up. Occasionally, the bearing shows a winding ball path, Figure 2. This may develop when the supporting shaft shoulder is wallowed out of contour, leaving the inner race tilted on the shaft. Adequate shaft shoulders precisely machined, sturdy supplemental locking members and caution in locating all adjacent parts will reduce this failure to an occasional status.

A related phenomenon may develop when some major shift occurs in the machine load, to produce a secondary ball-path marking. This condition appears with some frequency, and seems especially related to bearings undergoing a secondary period of service. It is perhaps due to the fact that the bearing never returns to precisely the same position; hence a second ball path is established.

Overloading. A failure which resembles normal fatigue failure (spalling of the bearing surfaces through cyclic stressing), but which is distinguished by excessively wide ball tracks, is shown in Figure 3. This is simply a case of overloading, in this instance prolonged. Overload has caused failure of the material as evidenced by breaking out of the surface layer of steel. Such failures start in a small area and spread rapidly. If the unit remains in service (some noise will attend bearing rotation when this condition first appears), the flaking will spread over both races and onto the ball surfaces. Overload often begins on the inner race, since this member sustains more ball impacts during a given time.

Dirty or Abrasive Mounting. Figure 4 illustrates the early penalty for negligence during handling and installation. One of these units was handled properly and protected during mounting. The other was filled with dirt and abrasive contaminants when it began service. Note that the unit at right has retained the original surface gloss, while the other has taken on a dull polished appearance caused by abrasive wear. It is not at all uncommon to find bearings worn as much as $^{3}/_{32}$ inch or more. Heavy and irregular loads are then shifted to couplings, gears, belts and related machine accessories when bearing centering accuracy drops in this amount.

Lubricant Oxidation. Figure 5 shows the formation of heavy sludge deposits caused by lubricant oxidation. Any tendency to sludge is harmful, and should be avoided for many reasons. Gummy deposits occupy vital lubricant space and retarded dissipation of generated heat. Another is that they interfere with necessary roll-cage freedom. Too, the hard, resinous materials form on the bearing surfaces,

About the Author

Johnny Riddle, sales engineer for Allied Bearings Supply Co., Inc., in Tulsa, has done advance study work in business at the Oklahoma School of Business in Tulsa. He also attended the Night School division of Tulsa University and studied marketing and salesmanship. Riddle has published many other technical articles in trade journals. A volume, "Ball Bearing Maintenance," was published in 1955 by the University of Oklahoma Press. It was well reviewed in both the U. S. and England.

FIGURE 7—Corrosives formed either by deterioration of lubricants or outside materials show a reddish brown coating at failure areas. The bearing may also have small etched holes over the exposed surface of the races as shown here. Etching may not appear on the ball path because the rolling action pushes lubricant away from line of motion.

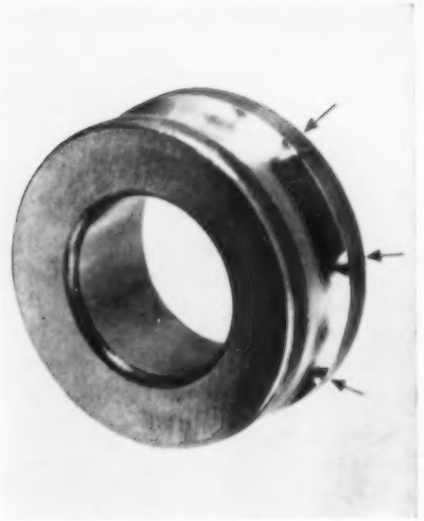


FIGURE 8—Too heavy mounting pressure will often cause ball depressions in side of raceways. Although shallower marks may frequently go unnoticed, damage is permanent and service life of a bearing will be shortened.

FIGURE 9—(At left) "False Brinelling" often occurs when bearings vibrate or have restricted rolling action. Even with light loads, changes in the surfaces of the raceways will result from minute axial rotational movements under each ball or roller bearing loaded as shown here. Wear may be the result of both chemical and physical actions.

FIGURE 10—(Above) Foreign matter, particularly hard, coarse metallic particles will produce small depressions that are distinct from those caused by overload or corrosion. A good example of this type damage is shown in the ball raceways here.

thereby intensifying the compressive stresses as the loaded balls or rollers pass over them. Premature fatigue failure may result; cage difficulties are often associated with this condition.

Overheating. The effects of extreme heat are shown in Figure 6. Mild over-heating causes some discoloration of the components. Total unit destruction develops only during extreme over-heating—normally at medium to high speeds. The initial cause which is frequently obscured, especially at the higher speeds, may be:

- Excessive load.
- Off-square, producing heat at retainer.
- Failure of lubricant source, when failure develops rapidly.
- Heat from an external source.
- Cramped bearings, either radially tight, caused by ring expansion during shaft mounting, or axially tight by squeezing one unit against another.

Heat not only oxidizes separators, but also softens the races and rolling elements when it is not conducted away from these members. Balls have occasionally been transformed to hollow spheres by centrifugal forces coupled with extreme heat.

Corrosion. Corrosive materials, or corrosives formed by deterioration of the lubricant, produce a type of failure indicated by a reddish-brown coating and very small etched holes over the entire exposed surface of the races, as seen in Figure 7. Frequently, the etching does not show on the ball path because the rolling action of the balls, or rollers, pushes the lubricant, loaded with corrosives, away from the line of motion. This produces a dull gray color on the rolling elements and in their paths, as contrasted with the reddish-brown color of the other surfaces.

Improper Mounting Pressure. Damaged rings often result from improper mounting practices, as seen in

Figure 8. This ring member shows three ball depressions, the center mark being the deepest. Shallower marks frequently go unnoticed because the edges of the brinelled depression are not clearly marked and no change appears in the surface of the raceway itself. Hence, they are sometimes difficult to see, even when magnified. Such damage results when the unit is struck forcefully during mounting, or when off-center pressure is applied. Damage is permanent and service life is greatly reduced.

"False Brinelling." Often mistaken for brinelling is so-called "false brinelling" which occurs when bearings vibrate or undergo restricted rolling action, especially in the presence of harsh foreign matter. Loads may be relatively light, but slight changes in the surfaces of the raceways result from even minute axial or rotational movements, and these appear under each ball or roller under load, as seen in Figure 9. When closely studied, this wear phenomenon is observed to be the result of both chemical and physical actions. What is more important, however, is that microscopic particles are freed by the vibrating movements. These in turn provide the abrasive matter for still further wear.

Wear Particle Abrasion. Foreign matter is highly detrimental; it may enter the bearing during initial assembly of the machine, during repairs, by seepage from the atmosphere, or even as adulterants in the lubricant. Damage thus caused varies considerably. Fine substances, or those soft enough to be ground fine by rolling action, will have an effect the same as that resulting from fine abrasive or lapping material. The races become worn in the ball paths, the balls or rollers wear, and the unit becomes loose and noisy.

Hard, coarse, metallic particles produce small depressions of a character different from those produced by overload, acid etching or corrosion. Damage thus inflicted is seen in Figure 10.

Part 2 discussing the influence of design features on maintenance and operation of bearings will appear in the October issue of PIPE LINE INDUSTRY.

CHECK LIST FOR TROUBLESHOOTING ANTI-FRICTION BEARINGS

Operator's Complaint

A—Overheated bearing
B—Noisy bearing
C—Replacements too frequent
D—Vibration
E—Unsatisfactory performance of equipment
F—Bearing loose on shaft
G—Hard turning shaft

TYPICAL CONDITIONS RESULTING IN BEARING FAILURES

Each condition could cause any one of the complaints listed in Column 2.

Condition	Complaint
Inadequate lubrication (wrong type of grease or oil)	A-B-C-G
Insufficient lubrication (low oil level—loss of lubricant through seals)	A-B-C-G
Excessive lubrication (housing oil level too high or housing packed with grease)	A-G
Insufficient clearance in bearing (wrong fit)	A-B-C-E-G
Foreign matter acting as an abrasive (sand, carbon etc.)	B-C-D-E-G
Foreign matter acting as a corrosive (water, acids, paints etc.)	B-C-D-E-G
Bearings pinched in the housing (bore out of round)	A-B-C-D-E-G
Bearings pinched in the housing (housing warped)	A-B-C-D-E-G
Uneven shimming of housing base (distorted housing bore—possibly cracking of base)	A-B-C-D-E-G
Chips in bearing housing (chips or dirt left in housing)	B-C-D-E-G
High air velocity over bearings (oil leakage)	C
Seals too tight (felt or leather cuff seals)	A-G
Seals misaligned (rubbing against stationary parts)	A-B-G
Oil return holes plugged (oil leakage)	A
Preloaded bearings (opposed mounting)	A-B-C-G
Preloaded bearings (two held bearings on one shaft)	A-B-C-E-G
Bearing loose on shaft (shaft diameter too small)	B-C-D-E-F
Bearing loose on shaft (adapter not tightened sufficiently)	B-C-D-E-F
Bearing too tight internally (adapter tightened excessively)	A-B-C-E-G
Split pillow block with uneven surfaces (oil leakage)	C
Spinning of outer ring in housing (unbalanced load)	A-C-D-E
Noisy bearing (flat on roller or ball due to skidding)	B-D-E
Excessive shaft expansion (resulting in opposed mounting)	A-B-C-E-G
Excessive shaft expansion (resulting in insufficient clearance in bearing)	A-C-E-G
Tapered shaft seat (concentration of load in bearing)	C-D-E
Tapered housing bore (concentration of load in bearing)	C-D-E
Shaft shoulder too small (inadequate shoulder support—bending of shaft)	C-D-E-G
Shaft shoulder too large (rubbing against bearing seals)	A-B-C
Housing shoulder too small (inadequate shoulder support)	C-D-E-G
Housing shoulder too large (distortion of bearing seals)	B-C-G
Shaft fillet too large (bending of shaft)	C-D-E-G
Housing fillet too large (inadequate support)	C-D-E-G
Insufficient clearance in labyrinth seals (rubbing)	A-B-C-G
Oil gage breather hole clogged (shows incorrect oil level)	A-C
Shafts out of line (linear misalignment)	A-C-D-E-G
Shafts out of line (angular misalignment)	A-C-D-E-G
Constant oil level cups (incorrect level)	A-C
Constant oil level cups (located against rotation of bearing)	A-C
Lockwasher prongs bent (rubbing against bearing)	A-B-E
Incorrect positioning of flingers (rubbing against covers)	A-B-C-G
Pedestal surface uneven (bending of housing causing pinching of bearing)	A-C-D-E-G
Ball or roller denting (hammer blows on bearing)	B-C-D-E
Noisy bearing (extraneous conditions)	B
Lubricant leakage and entrance of dirt into bearing (worn out seals)	C
Vibration (excessive clearance in bearing)	D-E
Vibration (unbalanced loading)	D-E
Hard turning shaft (shaft and housing shoulders out of square with bearing seat)	E-G
Bearing loose on shaft (knurling and center punching of shaft for bearing seat)	F
Discoloration of bearings (use of blow torch to remove bearing)	B
Oversized shaft (overheating and noise)	A-B-C-G
Undersized housing bore (overheating of bearing)	A-B-C-E-G
Oversized housing bore (overheating of bearing—spinning of outer ring)	A-B-C-D-E
Enlarged housing bore (excessive peening of non-ferrous housings)	A-B-C-D-E
Noisy bearing (false brinelling)	B

This list courtesy SKF Industries, Inc.

Variable-Diameter Scraper Simplifies Line Maintenance

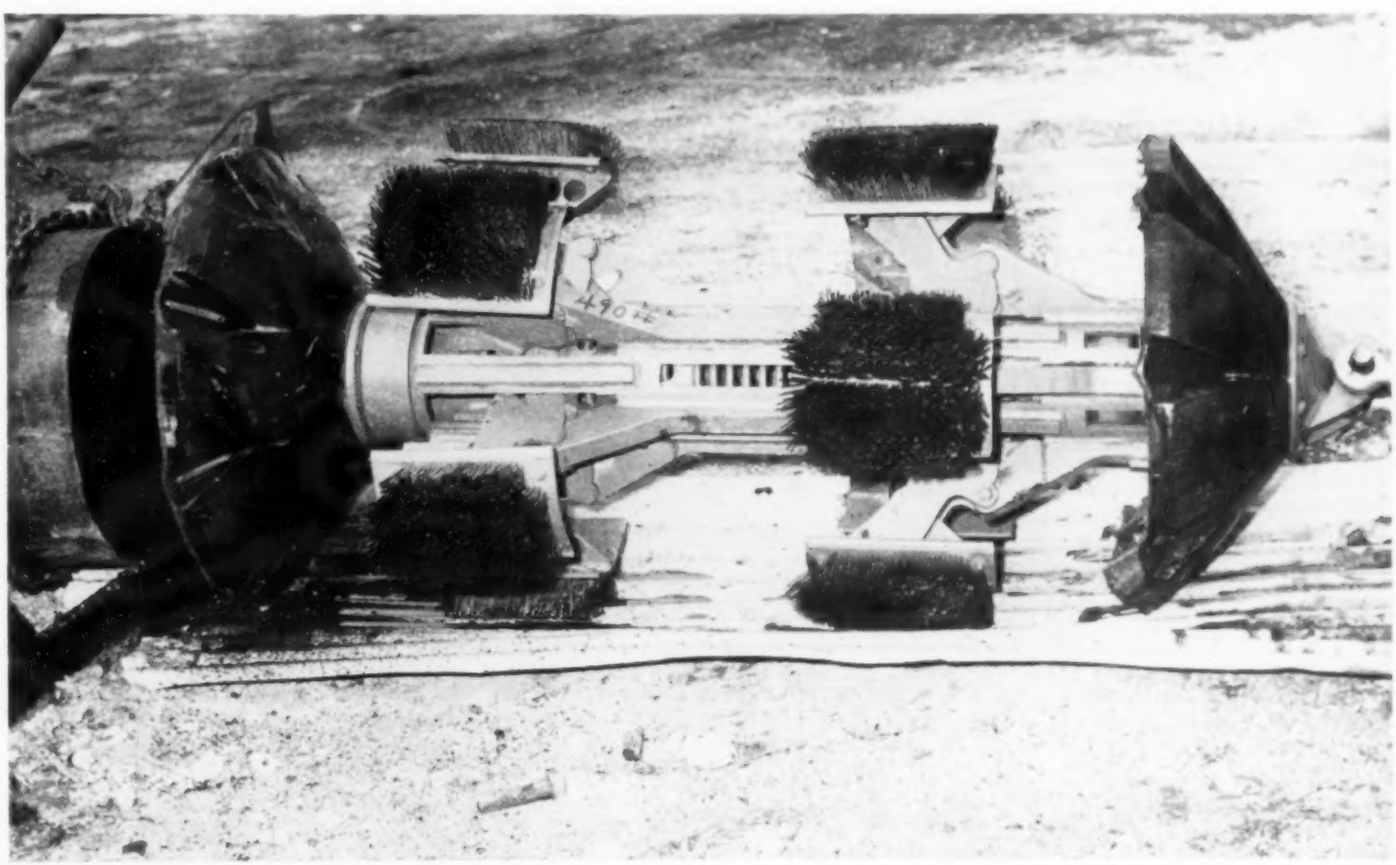
New scraper design eliminates need for scraper traps at junctions of varying diameter lines.

By **Richard F. Gavitt,** Service Pipe Line Company, Tulsa

OVER THE past 10 years, Service Pipe Line has followed a practice of connecting pipe line loops of several different diameters into a continuous line, eliminating the necessity for intermediate junctions. Necessity for scraping these multiple diameter lines required the development of a variable-diameter scraper. This new model, which has successfully passed its initial tests, is suitable for use in a range of pipe diameters; from 18 to 24 inches.

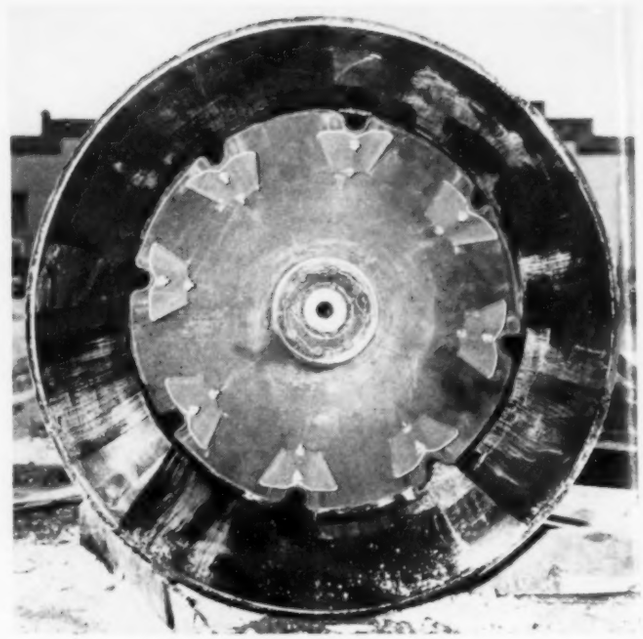
Design and fabrication of a size 18 to 24-inch scraper was greatly facilitated by the experience Service gained three years ago during earlier development work on a size 12 to 16-inch scraper. The earlier, smaller model was composed of two units connected with a special universal joint. Some difficulty was encountered with this connector. Also, the notch-type propelling discs used in the earlier scrapers did not prove satisfactory for the wider range of pipe diameters. From preliminary tests, it was concluded that a new type of propelling cup would have to be designed.

New Design Features. Mounting the brushes on parallel arms provides an even pressure on each brush as the scraper passes from a smaller pipe into a larger one. Flexibility is provided by "V" notches between the segments of the propelling cups permitting the



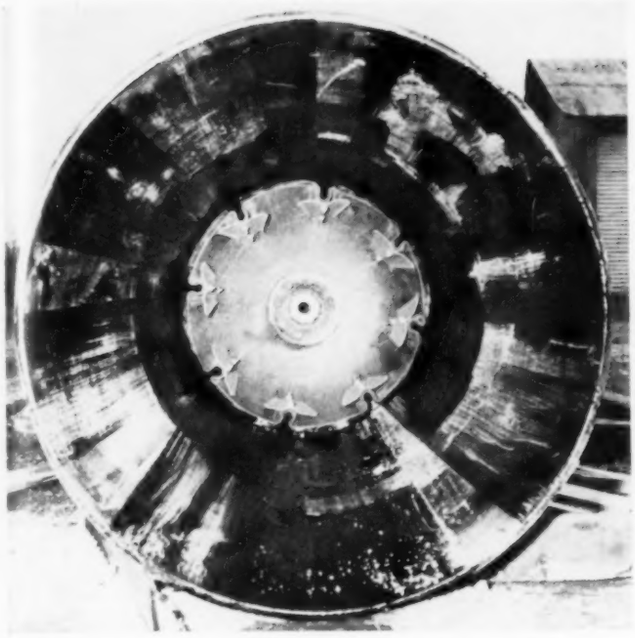
Service Pipe Line Company's 18 to 24-inch variable-diameter scraper makes it possible to "pig" lines of varying diameter pipe without requiring scraper traps at junctions. Cone-shaped, "V"-notched propelling cups are made of heavy rubber. Ten brushes are mounted independently in two sets of five and connected to coil mainsprings by a system of parallel arms.

End view of scraper in 24-inch section of test line. Test line also includes 22, 20, and 18-inch pipe. Note position of cone-shaped rear propelling cup, almost fully expanded.

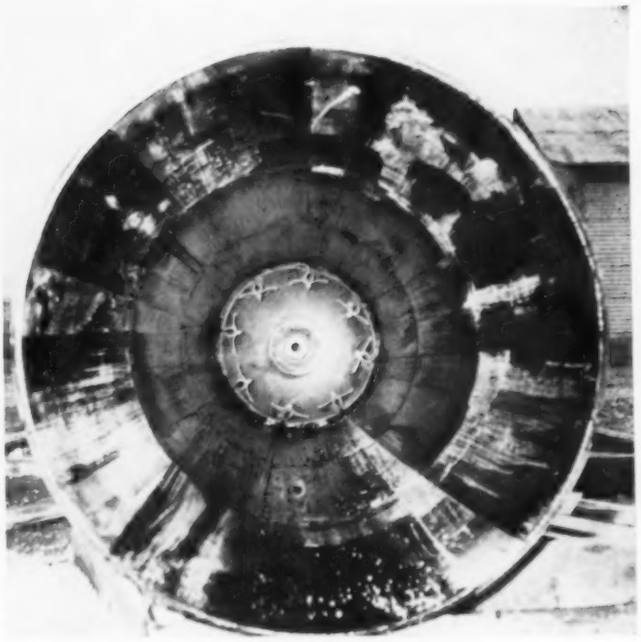


Scraper enters 22-inch section of test line. Cup has contracted, narrowing the "V" notches. The cone edge folds symmetrically along the grooves, automatically adjusting to pipe diameter.

Front propelling cup, fully contracted, emerges from the 18-inch section of test pipe. Position of grooves shows how bypass oil exerts a scouring action to pass accumulated sludge through scraper body and into the line ahead of the front cup.



Scraper proceeds to 20-inch section of test line. Smaller diameter pipe has caused notches to further contract. Each rubber propelling cup contains eight "V" notches on its perimeter.



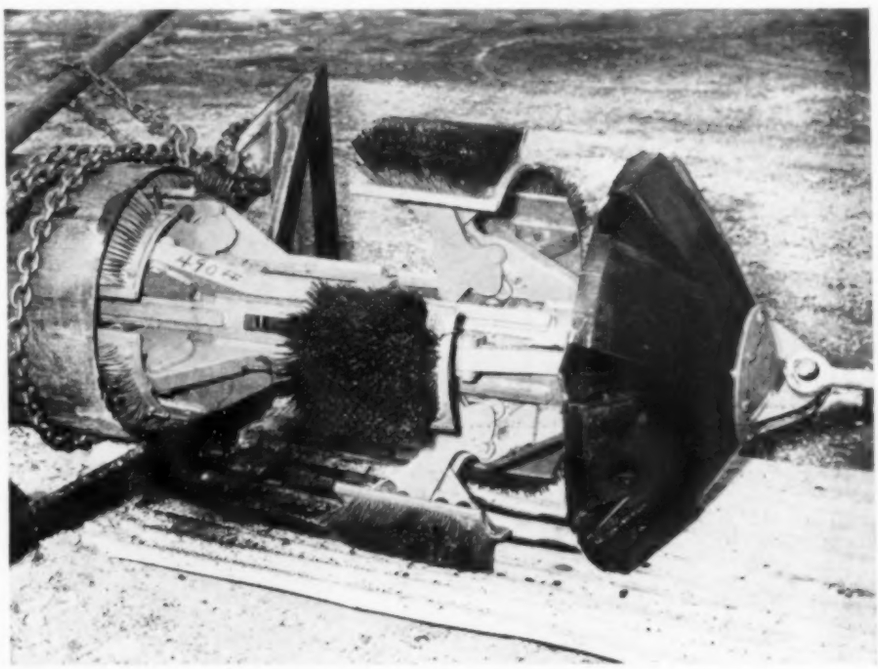
Scraper in 18-inch section of pipe with propelling cup fully contracted. Steel back-up plates strengthen notches. Openings allow some oil to bypass providing self-cleaning.

perimeter to expand or contract to fit varying pipe sizes. The notches also give the scraper a self-cleaning feature. Some of the oil flows through the grooves and washes the accumulated sludge out ahead of the scraper.

The initial test of the new design was conducted in March, 1958. Welders at Service Pipe Line's Tulsa shops, where the first model was fabricated, constructed a section of line ranging in diameter from 18 to 24 inches. Moving parts and rubber propelling cups were tested by pulling the scraper through by cable.

Trial Run Successful. A trial run was made through a 77-mile section of Service's 20-inch trunk line between Humboldt, Kan., and Freeman, Mo. Inserted at Humboldt station at 9:25 a.m., April 7, the scraper was scheduled to arrive in Freeman 62 hours later. Actually, because of a small amount of slippage, it entered the incoming trap an hour and a half late.

Results were generally satisfactory, although the degree of wear on the propelling cups was more than had been expected. Designers are now working on some detailed changes to improve the scraper before it is placed in service. The final model will be built with a body of aluminum alloy instead of steel; reducing the total weight from 490 pounds to about 200 pounds. Heavier mainsprings will also be used for the brushes, to give better centering action and reduce wear on the propelling cups.



Front set of brushes has expanded, while second set remains contracted in the 18-inch pipe. Note that linkage permits brushes to remain parallel to pipe wall no matter what the degree of expansion or contraction.

Brushes Linked to Coil Springs. Cleaning action of the scraper is carried out by two sets of metal-bristle brushes, five in each set, mounted independently on linkages to two central coil springs. Brushes remain parallel during expansion and contraction to fit varying pipe diameters. Each of the two cone-shaped rubber propelling cups contains eight "V" notches on its perimeter, strengthened by steel plates.

Eventually, Service expects to build similar scrapers in four size ranges; 8-10-12-inch, 12-14-16-inch, 16-18-20-inch and the 18-20-22-24-inch now being completed.

ACKNOWLEDGMENT

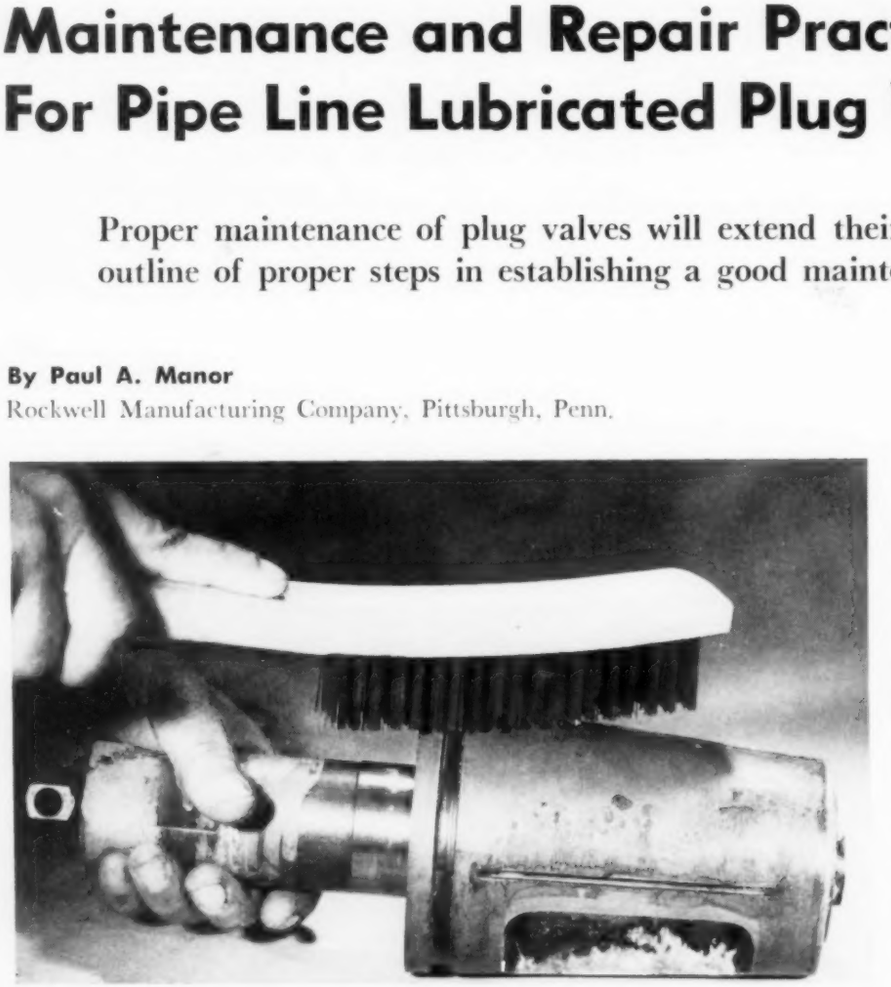
Author thanks Bill Terrell, Staff photographer, Service Pipe Line Co., Tulsa, for photographic presentation of scraper operation.

A well equipped valve service truck is valuable in the valve maintenance program. Such a truck may either be operated by the company or maintenance can be contracted. Equipped with an air compressor, air hose, lubricant, tools and spare parts, the truck can make the rounds of field or station installations.

Maintenance and Repair Practices For Pipe Line Lubricated Plug Valves

Proper maintenance of plug valves will extend their life indefinitely. Here's an outline of proper steps in establishing a good maintenance program.

By Paul A. Manor
Rockwell Manufacturing Company, Pittsburgh, Penn.



After disassembly of the valve, parts should be cleaned with a suitable alkaline or solvent solution. Wire brushing or abrasive blasting may be required to remove deposits. Tapered seats of both body and plug should be carefully examined for corrosion, pitting, scoring, galling or erosion.

PROBABLY THE most numerous and at the same time the simplest class of equipment found at pipe line installations are valves. Compared with pumps, compressors and other auxiliary equipment used on cross-country piping networks, maintenance and repair of valves is so easy as to sometimes be overlooked or ignored. But the fact of the matter is, valves alone can represent a substantial portion of the total investment in the pipe and equipment for a pipe line system.

Unless a considered approach is taken to all valves and a sound, planned program of maintenance organized and executed, pipe line operating costs in terms of product loss and inefficient operation due to poorly maintained valves, can be high. And cumulative maintenance costs, be-

Check the lubricant grooves or ducts to determine if they have been cut away during re-machining, or need to be deepened. If any are missing or greatly reduced in depth, they should be reproduced either by chipping, machining or grinding. Location of grooves should be the same as in the original bore.

After the plug is machined down to the point where it will enter well into the body seat, the taper should be checked very closely with strips of "feeler stock." It may be necessary to repeat this procedure, taking light trial cuts and adjusting the lathe taper attachment until an exact fit is obtained.

cause periodic maintenance is ignored, can be exorbitant.

Valve Maintenance Simple. Properly approached valve maintenance is probably the lightest load the operating and maintenance crew has to bear. A well-run maintenance program can add years to valve life, substantially reducing operating costs and virtually eliminating the need for valve replacement. This is particularly true in the case of lubricated plug valves. This type of valve is frequently used where tight, leak-free operation is essential. It is also used as a block valve, as a blowdown valve and sometimes for throttling purposes.

The lubricated plug valve is probably the simplest of any type, and routine maintenance is an easy task. But because it is used in critical areas, an organized maintenance program is of particular importance.

Types of Programs. Maintenance procedures for lubricated plug valves vary widely among petroleum operations. One western company operates a special valve service truck, a self-contained maintenance department. Equipped with an air compressor, air hose, lubricant, tools and spare parts, the truck makes the rounds of the company's pipe lines at intervals of from 2 weeks to 6 months, servicing over 15,000 valves.

At a large southwestern installation the procedure is the same, but the truck is operated by the valve manufacturer on a contract basis. A large Eastern company prefers to localize valve servicing within areas; the foreman supervises valve maintenance within his area, while the refinery maintenance crew takes care of any large-scale valve repair or reconditioning.

Each of these procedures is equally satisfactory. There is no best way to set up a valve maintenance schedule, and each company can find the method that best fits its operation. The important thing is that valve maintenance be established on a regular basis.

Service Determines Frequency. The frequency with which lubricated plug valves should be serviced will vary with the frequency of valve operation, nature of the line fluid, temperature and other factors. Valves on a major manifold are usually serviced daily, while infrequently-used valves on gas transmission lines may go six months or longer without lubrication.

The following list may be helpful as a general guide for regular lubrication.

1. Refineries, gasoline plants and compressor plants—once a week.

2. Gas, crude and products pipe lines—once a month.

3. Valves infrequently used, as on gas distribution systems—every six months.

4. Valves on corrosive fluid lines—twice a week.

5. Valves operating many times at high temperatures—daily.

Given the same regular maintenance as other oil industry equipment lubricated plug valves give years of effective service—many original installations are still in use after more than 20 years on christmas trees, pipe lines, manifolds and distribution systems.

Repair Versus Replacement. In

Applying the lapping compound to bearing surface of plug. The grit is suspended in a non-lubricating oil emulsion. Sufficient space should be provided between the plug and body to permit the lapping compound to spread evenly and produce uniform action.

The final step in making close body-and-plug fit is lapping valve by hand. Lapping is continued until all machining marks disappear and the surface shows a uniform finish. Rotation of plug in body should show an even metal-to-metal contact without excessive bright or dark areas.

the case of valves which have seen long, hard usage, the question of repair versus replacement is sometimes hard to determine. A certain amount of repair is, economically justified. Often by merely cleaning or packing a valve it may be restored to useful service. More extensive repairs are also justified. But a point is eventually reached—depending upon the size of the valve and the time required for repair—when it is cheaper to replace than repair.

All lubricated plug valves are worth reclaiming if their condition is such as to require only cleaning, inspection, and reassembly with new packing and gaskets. A light re-lapping operation may be required to eliminate scaly deposits and superficial scoring or pitting.

Judgment must be exercised in cases where the valve body may require reboring and fitting with an oversize plug, or building up of surfaces with weld metal. This type of work is not economically justified for low and medium pressure valves. As a general rule, complete rebuilding of a 4-inch and smaller 175#WOG or 2-inch and smaller 200, 400, 500 and 800#WOG semi-steel valves should not be undertaken. The final decision to repair or not will involve consideration also of available equipment, labor and overhead rates.

Repair procedures may be performed either in the field or in an outside repair shop.

Cleaning and Examination. Valves which have seen long service may have an exterior coating of dirt, paint or other foreign matter. The valve should be cleaned before disassembly.

After complete disassembly, parts should be cleaned with any suitable alkaline or solvent solution. Wire brushing or abrasive blasting may be required to remove deposits from corroded areas. Tapered seats of both body and plug should be carefully examined for corrosion, pitting, scoring, galling or erosion. For plugs with integral shanks, the machined shank diameter and the adjacent shoulder on the plug should be similarly examined.

The extent and depth of blemishes in seating surfaces of both plug and body will determine the repair procedures necessary to restore the valve to good operating condition. Here are some typical cases:

Case 1: Corrosion or scoring is quite shallow. Here the valve may be returned to service by relapping the plug in the body without machining seating surfaces. In the case of integral-shank plugs, however, the shank diameter and adjacent shoulder must be resurfaced by turning or grinding before relapping.

Case 2: Corrosion, galling or scoring of moderate depth. It will be necessary to remachine the tapered seating surface of the body. This operation usually requires an oversized plug to match the oversizing of the taper bore.

Case 3: Severe corrosion, galling and deep scoring. In order to restore the tapered seating surface, it will be necessary to rebuild the worn areas in the body before machining the valve body bore. Rebuilding can be done by an approved welding or brazing process on steel bodies only. This process is not recommended.

Valve plugs are individually fitted and lapped to the bodies by the manufacturer. Replacement plugs are furnished oversize with a semi-

About the Author

Paul A. Manor, chief engineer of the Central Valve Research and Development Division of Rockwell Manufacturing Co., attended Ohio State University and the University of Toledo. He had been chief engineer at Rockwell's Barberton, Ohio, Valve division before being promoted to his present position in 1957. Before joining Rockwell in 1954, Manor was chief project engineer for the Surface Combustion Corporation, in Toledo. He is a member of the ASME, American Petroleum Institute, Manufacturers Standardization Society and the American Standards Association.

(At left) Accuracy of fit is checked by bluing the plug, inserting it in the body and rotating it ¼ turn under light pressure. Any mismatching, off-taper cut or out of roundness will be apparent on examining the plug.

finished taper to allow metal stock for fitting to rebored bodies. Most valve bodies are designed with ⅛-inch extra metal thickness at the tapered section to permit one or more re-boring operations without reducing wall thickness below allowable limits. Replacement plugs are generally furnished to standard oversize tapered dimensions. Plugs with greater oversize can, under exceptional conditions, be obtained on special order from the manufacturer.

Re-machining Valve Bodies and Plugs. An accurate lathe with taper attachments set 4½ degrees from centerline should be used for re-machining bodies and plugs. In some cases, the body casting need only be set true to the original bore; in others it must also be aligned with the threaded plug stem hole. Eccentricity of the stem hole with the taper bore in the body should not exceed 0.005 inch; otherwise a binding action will result between the plug stem, equalizer ring and the tang on the plug after the valve is assembled.

A trial cut should be taken to check correctness of set-up and taper angle. Sufficient cuts should be taken to remove all blemishes, and the final cut should produce a smooth, straight, round bore. After the bore is machined, the lubricant grooves or ducts on the body should be checked. If any are missing or greatly reduced in depth, they should be reproduced either by chipping, machining, or grinding; they should be located in the same position as in the original bore.

Before machining the plug, the taper should first be machined to caliper-and-scale dimensions taken from the valve body. Sufficient metal should be allowed for final matching of taper and diameter. After the plug is turned down to the point where it will enter well into the body seat—but not all the way—the taper should be checked very closely with strips of "feeler stock" placed between the plug and the body near both ends of the taper. It may be necessary to repeat this procedure, taking light trial cuts and adjusting the lathe taper attachment each time, until an exact fit is obtained.

After the taper is exactly matched, further light cuts are taken until the plug enters the body with the plug shoulder below the body gasket seat a distance about equal to the minimum dimensions allowed by the manufacturer. This will allow for a slight further drop of the plug in the final lapping operation, without exceeding the manufacturer's maximum dimensions.

Lapping. If preliminary machine work has been done properly, it should be necessary to do only enough lapping to take out tool and grinding marks and produce a smooth finish on the taper surface.

Before the lapping operation is started, all sharp edges of both body and plug should be de-burred with either a file or emery cloth, and bearing surfaces should be cleaned and free of dirt or metal particles. Valves may be lapped by hand or with an upright drill press. If a press is used, the valve body should be secured to either the table or the base and the plug rotated through a floating attachment connected to the spindle. Sufficient "float" must be provided to prevent the plug from lapping out of round in the body.

The lapping compound may consist of a 220-grit aluminum oxide for steel, or a 200-grit silicon carbide for iron valves. The grit is suspended in a non-lubricating oil emulsion. Sufficient space should be provided between the plug and body to permit the lapping compound to spread evenly and produce uniform action.

Lapping is continued until all machining marks disappear and the surface shows a uniform finish. Rotation of the plug in the body should now show an even metal-to-metal contact, without excessive bright or dark areas. The accuracy of the fit can be checked by bluing the plug, inserting it in the body and rotating it ¼ turn under light pressure. Any mismatching, off-taper cut or out of roundness will show clearly when the plug is removed and examined.

After lapping is completed, the depth of the plug in the body should be checked against manufacturer's specification. **—The End**

Special Maintenance Report

Guard and Circuit-Testing Channel

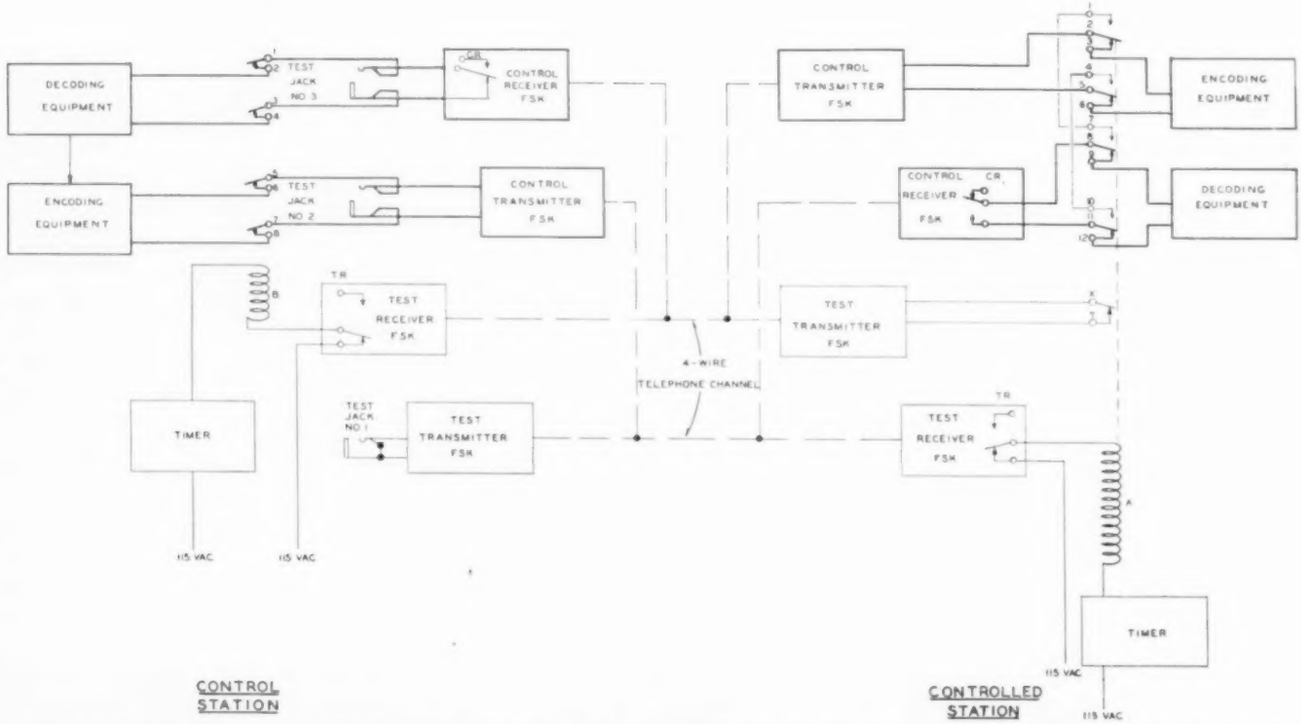
Reliable operation of automatic and unattended stations can be assured with this method of checking control circuits.

By W. J. Benton
Sinclair Pipe Line Company
Independence, Kans.

MOVING A pump station's controls from a control room several hundred feet from the pump to the dispatcher's control console several hundred miles away is becoming routine. But the maintenance of equipment for encoding, transmission and decoding control directions requires techniques and skills far different from those used if the console were only a few feet from the motor being controlled or the gage being read.

Maintenance takes on an entirely new form. Much work that was previously called maintenance is really repair. Many workmen believed they were doing a good maintenance job if they were able to promptly isolate and repair a fault. But when the sequencing, encoding and decoding equipment contains hundreds of multiple contact relays and when the control channel is relayed by 20 microwave stations, some of which contain as many as 450 vacuum tubes, a breakdown maintenance program just won't work.

Design Important. It is the responsibility of the designer of the individual equipment units and the system as a whole, to provide units and an assembly of units which require as little maintenance as possible, consistent with simplicity and economy. It is further the responsibility of the designer to enable maintenance men to determine the optimum performance of each component sub-assembly. All too often a unit will function satis-



Basic schematic of circuit employed for guard and circuit-testing channel. Control equipment and circuitry is shown in heavy outline. This circuit is possible since the FSK equipment used is furnished with two receivers and two transmitters per chassis.

factorily in the shop but because of some oversight or because of a narrow degradation margin, be very difficult to maintain. Actual operating experience added to the primary design experience will make it possible for the designer, or someone in his organization, to write a technical manual that will describe the function of each component and tell maintenance men what test equipment to use and what readings should be obtained to determine optimum performance.

Preventive Maintenance Necessary. If general purpose test equipment is not available, special test equipment should be designed and made available. The vendor who, knowing that cost is a prime consideration, says that his equipment, although it has no built-in test equipment, can be maintained with a burnisher and screwdriver is rendering a disservice to both himself and the buyer. On the other hand, the buyer should accept this statement as prima facie evidence that either the individual making that statement or the company he represents has had very little operating experience with the equipment in question.

Introduction of machines to perform mechanical operations formerly done by men has made pipe line operation more dependent on men than was the case under local manual control. The best equipment available will give unsatisfactory service if not properly maintained. Even poor equipment will give satisfactory operation if the man maintaining it is good enough.

Spare Receiver Useful. The testing and guard channel was a logical development. Encoding and decoding equipment used for pump station control should be self protecting, which is easily accomplished. One method is to use a code similar to a dial telephone number using a set-up code, with answer-back, immediately prior to the operate code. Unfortunately, the equipment involved is protected only against man failure at the control station. A power failure at one of the intermediate radio relay stations would cause a chattering of the FSK control receiver relay which can result in undesired operation due to the fact the code was duplicated by the relay chatter.

The FSK equipment used is furnished with two receivers and two transmitters per chassis. Since over 99 percent of the failures were the result of interruption of the four-wire telephone channel, undesired operation at the controlled station due to these failures could be eliminated by looping the control relay leads through the spare FSK receiver relay contacts. Then anything that happens to the telephone channel to open the control receiver relay will also open the spare receiver relay, thereby opening the control circuit.

Interruption Opens Circuit. Figure 1 shows the basic schematic of the circuit employed. The control equipment and circuitry is shown in heavy outline. At the control station the test transmitter is made to transmit a mark signal by means of the tip-normal to sleeve connection of Test Jack No. 1. This keeps the test receiver Relay TR contacts in the position shown which keeps Relay A at the controlled station energized. With Relay A energized Contacts X-Y are closed which causes the test transmitter to send a mark signal to its associated receiver at the control station thereby keeping its relay contacts in the position shown. This keeps Relay B energized. With Relays A and B energized the contacts are in the position shown and the encoding and decoding equipment at each station is connected together by the FSK channel to constitute a complete control channel.

Should the telephone channel be interrupted for an interval of the order of five milliseconds the test receiver receiving the interruption will open its TR relay contacts de-energizing the associated cut-off Relay A or B and thereby disconnecting the control FSK receiver from its associated decoding equipment. If the interruption is toward the controlled station, de-energizing cut-off Relay A will open Contacts X-Y thereby causing the controlled station test transmitter to send a space signal reversing the position of TR relay contacts at the control station to notify the maintenance supervisor of the outage.

The timer was incorporated to delay the reclosing of cut-off Relays A and B. This was done since most interruptions are caused by power failures or switchover to standby relay equipment. Reclosing Relay A during engine-start or switchover would cause undesired pulses to be received by the decoding equipment. Except for some difficulty with timers this arrangement has been satisfactory. When a timer can be found that will operate fast enough and not stick, the assembly will completely meet the need.

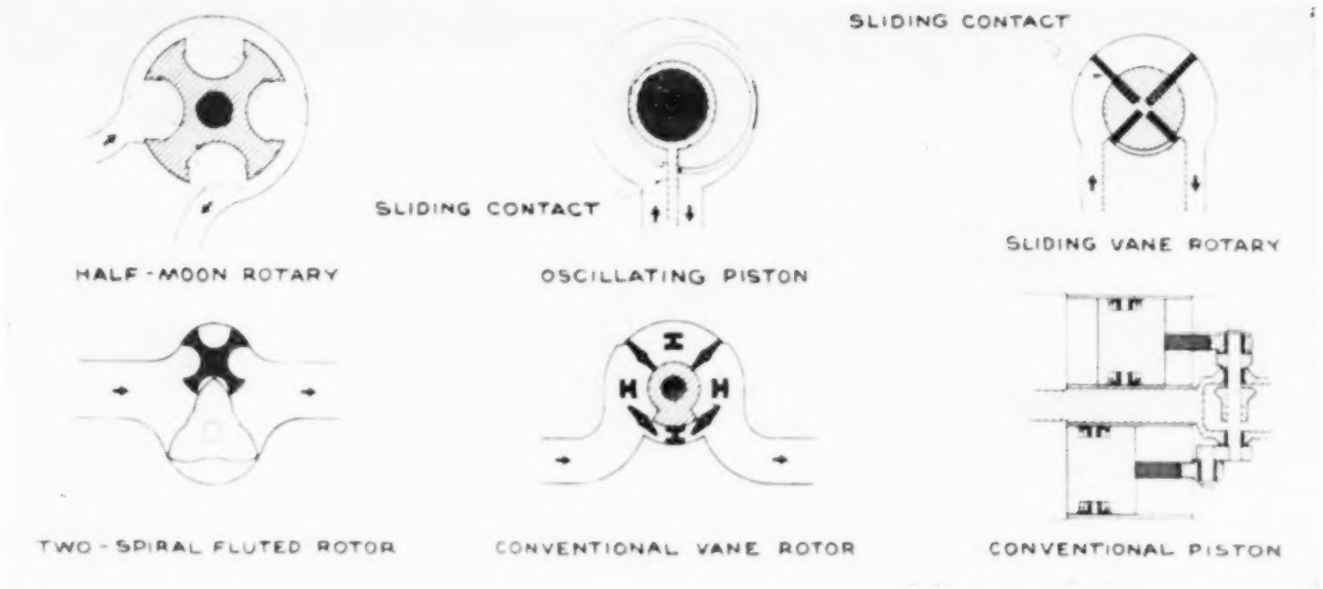
Checks Control Channel. In addition to providing two-way channel supervision this arrangement also provides a way to test the control channel in both directions from the control station independently of the encoding and decoding equipment. Insertion of an open plug in Test Jack No. 1 at the control station will cause a space signal to be transmitted to the associated test receiver at the controlled station thereby reversing its TR relay contacts and de-energizing cut-off Relay A. With Relay A contacts reversed from the position shown the CR contacts of the FSK receiver are connected to the DC input of the FSK transmitter at the controlled station. This condition will remain until after Test Jack No. 1 at the control station is reclosed. Make-break signals transmitted at Test Jack No. 2 will be received at Test Jack No. 3. A comparison of the received signal to the transmitted signal is made and logged daily, thereby charting circuit degradation.

ACKNOWLEDGMENT

From a paper presented at the AIEE Southwest District Meeting, Tulsa, March 31-April 2, 1958.

About the Author

W. J. Benton, assistant superintendent of communications for Sinclair Pipe Line Co., received a B.S. degree in electrical engineering from Southern Methodist University, Dallas. After working as a field engineer for Western Union Telegraph Co., he joined Sinclair Pipe Line as a methods engineer. He was promoted to senior engineer in 1949 and to his present position in 1956. Benton is a registered professional engineer in Kansas, an associate member of the American Institute of Electrical Engineers and a member of the Institute of Radio Engineers.



Six principal types of positive displacement meters. Choice depends on specific application. Rotary type meter is most common for pipe line applications. The measuring chamber or chambers are designed with a known volume, and, as the internal mechanism revolves, oscillates or reciprocates due to line fluid pressure, the number of known volumes are counted and recorded.

P. D. Meters—Selection and Care

When kept calibrated and in good repair, they will give accuracies better than 0.1 percent, when used within 30 to 100 percent of capacity.

By Paul A. Mankin
Rockwell Manufacturing Company, Pittsburgh, Penn.

ONE OF THE first steps in preventive maintenance of a meter is the selection of the proper meter for the service. Uses of positive displacement meters are growing and now range from metering petroleum products at 400° F. to liquid oxygen at —360° F. To meet these varying needs many designs are available.

Basically a PD meter is a device consisting of a measuring chamber or chambers, a means of sealing between metered and unmetered products, some type of registering mechanism to record the measured product and an arrangement to transmit the measuring element to a register. The measuring chambers are designed with a known volume and as the internal mechanism revolves, oscillates or reciprocates over a fixed path within the meter body due to line fluid pressure, the number of known volumes are counted and recorded.

Proper Meter Selection. In selecting a meter for an installation, the following data should be known:

- Liquid to be metered
- Line pressure
- Viscosity or specific gravity of liquid
- Flowing temperature
- Lubricating properties of liquid
- Corrosiveness of liquid
- Presence of entrained solids
- Percentage accuracy required
- Maximum and minimum rate of flow
- Pipe size

Materials of construction for the meter and some accessories depend on contamination and corrosive properties of the liquid to be metered. Meters and accessories constructed of all-stainless steel and all-bronze, as well as all-ferrous, are in common use.

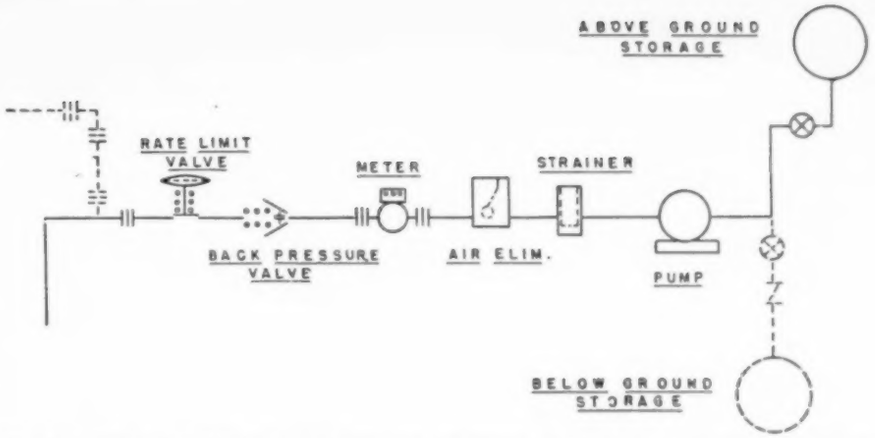
Other factors which must be known are the functions that the meter must perform in addition to measuring the liquid and the type of registering or recording mechanism desired.

Meter Accessories. Strainers, air or vapor eliminators, temperature compensators, back pressure valves and rate-of-flow control valves are considered part of most meter installations. On many installations other special accessories are used to automate the metering system.

A strainer is a simple but extremely important part of the metering system since considerable meter damage can result through fouling with dirt or other foreign material. The strainer should be installed as near as possible to the inlet side of the meter. On rotary type positive displacement meters it is practical to remove the metering mechanisms, which is usually called the rotor assembly, from the meter body or housing and flush and clean a new system to remove pipe

scale, welding beads, or other foreign materials that may have entered the system during construction. The strainer basket should be cleaned frequently since a loaded strainer will reduce the rate of flow through the meter.

An air eliminator is essential in many metering systems for the separation of air or vapor from the liquid. Any air or vapor passing through the meter will give a false indication. Normally the air eliminator is installed as close to the meter as possible, with the strainer separating the meter and air eliminator.



Typical meter installation. Strainers, air or vapor eliminators, temperature compensators, back pressure valves and rate-of-flow control valves are considered part of most meter installations. On many installations other special accessories are used to automate the metering system.

Trouble Shooting Rotary PD Meters. Most pipe line meter installations use a rotary type positive displacement meter. On a meter of this type, the elements are designed with a known cross-sectional area and volume between elements. These elements revolve in a fixed path, and on each revolution the constant cross sectional area (measuring chamber) is returned upstream for the next displacement. Counting of the revolutions of the meter is accomplished by suitable gearing between the measuring chamber and the register, thereby indicating or recording the total volume of liquid passed through the meter. In calibrating a rotary PD meter, it is not possible to change the volume of the measuring chamber; a mechanical adjustment is used to advance the register reading to make it coincide with the actual volume put through the meter.

Possible meter errors include under-registration, over-registration, inability to repeat, reduced rate of flow, complete stoppage of both meter and liquid flow and stoppage of meter register but liquid still flowing.

Under-Registration. When the volume put through the meter is greater than the amount recorded on the registering device, the following parts should be checked:

- Calibration adjustment for worn parts causing improper advancement of register.
- Gear train and register for worn and defective parts.
- Worn internal rotating parts imposing a load which increases pressure drop permitting more leakage through the designed clearance of the measuring element.
- Internal rotating and non-moving parts for score marks from abrasive material.

The scoring could be sufficient to cause mechanical interference imposing drag. If under-registration is experienced on a new meter check:

- Internal parts for mechanical drag caused by foreign material passing through the meter.
- Calibration adjustment for improper setting.
- Gear train arrangement for improperly secured gears.
- Meter for damage in shipment.

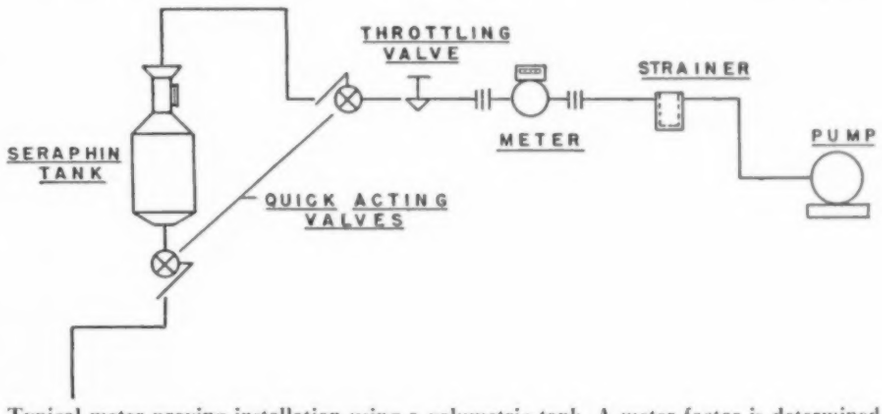
Over-Registration. All meters will measure air or vapor causing the meter to register a larger volume than is put through it. Over-registration could be caused by:

- Faulty air eliminator
- Plugged air vent line
- Restrictions in system causing vaporization of product
- Leak on suction side of pump
- Improper setting of meter adjustment
- Erratic registering mechanism.

Repeatability. Occasionally, repeatable results cannot be obtained when proving a meter. One time the meter register will read high and the next time low. When this happens, the cause can usually be attributed to a worn or defective adjustment, worn or defective gear train, register or valve leakage in system.

Reduced Rate of Flow. If the rate of flow through the meter is reduced, check the system for restrictions, open air eliminator vent or other lines upstream of meter, worn pump, worn meter or an excessive amount of mechanical interference in the meter as the result of foreign material or parts worn sufficiently to cause metal to metal contact. The restriction could also be a plugged strainer or pipe, or a partially closed valve.

Complete Stoppage of Both Meter and Liquid Flow. A large foreign particle left in the pipe line at the time of installation could jam the pump or meter causing complete stoppage. If the meter does not stop in-



Typical meter proving installation using a volumetric tank. A meter factor is determined each time the meter is proved. Besides giving a correction factor for computing the net volume run, the meter factor is a good check of the meter condition. If the correction factor begins to vary widely, it is an indication that the meter should be repaired.

stantly, check system for a faulty valve or a restriction in the line that continues to get larger due to build-up of sediment. It is always good policy to check the supply volume.

Stoppage of Meter Register but Liquid Still Flowing. When the meter fails to register flowing liquid check for a broken shaft, gear or pin in gear train of meter and register.

Maintaining Meter Accuracy. To maintain the accuracy of measurement necessary, PD meters on pipe line installations are proved at least once a month. Most meters are proved volumetrically using a calibrated prover tank. The size of the tank will be determined by the capacity of the meter; usually this capacity should be equal to the maximum rate of flow of the meter for one minute. Prover tanks can be either permanent or portable. For maximum accuracy the tanks should be recalibrated periodically. Prover tanks for pipe line installation are calibrated using Bureau of Standard certified measuring vessels. The calibrated volume is stamped on the prover tank.

Important Points in Prover System Design. A protective lining should be applied to the tank to protect it from corrosion and consequent changes in volume. A lining also provides an interior surface which will retain less fluid when it is drained and is more resistant to depositions. The design of the tank should permit fast filling to eliminate foaming and keep vapor loss at a minimum. A prover installations should meet the following requirements:

- The prover tank must be level.
- A meter should be tested in its normal operating position.
- The viscosity of the test liquid should be similar to that of the metered product. A difference in viscosity will effect meter accuracy.
- The meter should be as close to prover tank as possible.
- The throttling valve should always be on the down stream side of the meter to guard against vaporization of light petroleum products and industrial fluids.
- A quick opening and closing valve should be used in discharge line to start meter as fast as possible and to stop meter on the desired quantity. Avoid long period of topping-off on prover tank as accuracy will be affected, particularly if the topping-off rate of flow is lower than the rated minimum capacity of the meter.
- A quick opening and closing valve should also be used on prover tank discharge line to control the draining time and to reduce the time of the test cycle.
- A prover tank should be 100 percent wetted before checking meter accuracy and on wetting the tank the meter register should be disregarded. There is a certain amount of clingage of the liquid to the prover tank and the clingage will not change on subsequent test runs providing the drainage time of the prover stand is the same on all tests. This will assure uniform results.

Proving a PD Meter. Procedures outlined by the API Std. 1101 are followed in proving pipe line meters volumetrically. A meter factor is determined each time the meter is proved, and this factor is printed on the run ticket and applied to the recorded volume measured by the meter. Besides giving a correction factor for computing the net volume run, the meter factor is a good check of the meter condition. As long as the meter factor remains relatively constant, the meter is in good repair. If the correction factor begins to vary widely, it is an indication that the meter should be taken out of service and repaired.

Important steps in proving a meter are:

1. Start with a wetted tank.
2. Reset register to zero.
3. Test meter at its minimum, maximum and operating rates of flow.
4. Operate the meter to the quantity on the register equal to the prover tank capacity.
5. Record the average over and under delivery in percentage of cubic inches. This is taken from the calibration plate on the prover tank.
6. Repeat test as much as four times to eliminate the human error.
7. The percentage of error should be the same at minimum and maximum rates of flow. The reason being that the performance curve retains its shape on all meters. If proper results are attained on these tests, the meter can be adjusted to 100 percent at its normal operating rate of flow. If the error is different at maximum and minimum rates of flow or are out of the allowable tolerances as recommended by the manufacturer, there is a mechanical fault in the device. Check the meter, register, gear train and etc. for worn or defective parts.
8. If the temperature of a liquid changes between the time it passes through the meter and the time the tank is read or if the meter is temperature compensated, temperature correction must be made to tank records. It is a good policy wherever practical to check pressure drop across meter at the time of the test to determine if the meter is functioning properly and that there is no mechanical trouble. The pressure drop recorded should fall closely on the pressure drop curve supplied by the manufacturer.

Accuracy of PD Meters. PD meters, if kept calibrated and in good repair, will give accuracies better than 0.1 percent, when used within 30 to 100 percent of capacity. At one installation a pipe line company has purchased more than 1 million barrels of oil with an accuracy of 0.015 percent.

—The End

About the Author

Paul A. Mankin received his engineering degree from Purdue University in 1939. As chief engineer for Rockwell Manufacturing Co.'s Central Liquid Meter Research and Development department in Pittsburgh, Penn., his jurisdiction is over the company's entire petroleum and industrial measurement development program as well as directing engineering developments. Past experience includes engineering positions in industrial maintenance engineering, government engineering contract work through National Scientific Laboratories, development engineering in the field of electromagnetic integrating devices used in the measurement of conductive liquids, design engineering of special meter and register mechanisms, metal work processing and plant layout design.

FIGURE 1—Working electrical equipment such as motors, generators, transformers, heating elements, relays etc. are more likely to develop insulation failure than static equipment such as wiring, requiring more frequent checks. Here a resistance tester is being used to check the insulation resistance of the stator winding of an electric motor.

Reduce Electrical Equipment Downtime

Periodic checks of electrical equipment insulation resistance assures reliable operation.

By Richard W. Inman
Associated Research, Inc., Chicago

PREVENTIVE maintenance of electrical equipment should start with a check of the resistance of electrical insulation. A lowering of insulation resistance indicates deterioration and increases the chance of an unexpected breakdown. Since good insulation materials are also generally good wearing materials, the problem of weakening or faulty insulation may easily be disregarded until valuable equipment or critical wiring systems fail in use.

Although insulation appears inert and lifeless, it is continually subject to severe stresses, even under normal operating conditions. These stresses, which cause progressive weakening of its insulating value, are caused by moisture, heat, dirt, vibration, wear and aging. During an ON-OFF operation cycle of a motor for instance, the heating and cooling of the motor heats and cools the insulation over a wide range of temperatures. Resulting

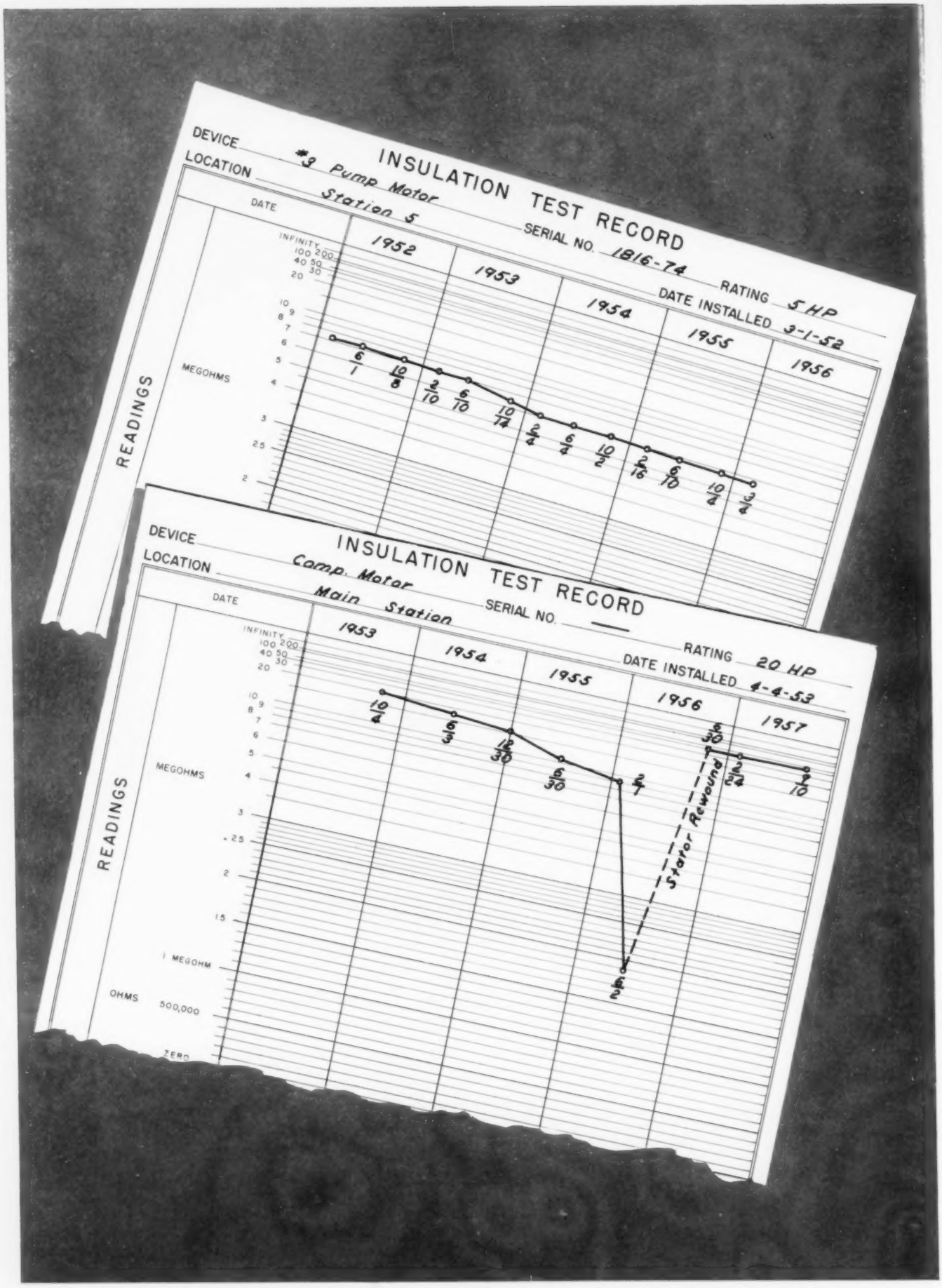


FIGURE 2—In checking insulation resistance, a change in resistance is the indicator, making keeping records of tests necessary. Chart A shows a motor whose insulation is aging properly. Chart B shows a sharp drop during the middle of 1956 indicating early failure of the winding. The stator was rewired and the resistance returned to a safe value.

mechanical strains set up in the insulation can eventually become breaks causing direct short circuits or serious power losses.

Moisture causes breakdown. Moisture in electrical equipment (from water spray or high humidity atmospheres) requires good maintenance attention. Under such conditions, the rising temperature of a starting motor allows the air around it to absorb the moisture; and a portion is absorbed by the insulation of the windings. On cooling, some of this moisture condenses on the insulation, and aids the expansion-contraction effects in deteriorating the insulation. Even a damp, high humidity day creates this effect, lowering the insulation resistance of all electrical equipment. Flooding or other accidental immersion of electrical apparatus calls for special treatent in drying and cleaning.

Dirt is also a constant enemy of insulation because almost all casually collected dust, lint, grease etc. are good electrical conductors and are capable of penetrating minute cracks and faults in insulation. Keeping electrical equipment clean is thus a primary rule of preventive maintenance.

Vibrations due to nearby machinery, steam lines etc., as well as wear and aging, are generally less severe than insulation damage caused by water, heat and dirt . . . and all of them operate relatively slowly. But they nevertheless steadily act to lower the resistance properties of the insulation.

FIGURE 3—Insulation resistance testing of a wiring circuit with a vibrator type tester. Tests of wiring and like apparatus are usually adequate on a yearly basis unless working conditions are particularly bad.

Testing insulation resistance. Periodic maintenance checks with an insulation resistance tester will indicate a weakening before a breakdown of any part of electrical equipment or systems occurs. As the deterioration progresses, the megohms of resistance of the insulation decrease in value to an eventual short circuit unless the steady decrease is found and the cause checked.

Megohm resistance is generally measured by "insulation resistance testers" or as they are often called, "megohmmeters." These instruments consist of a self-contained power source for the DC testing potential and a current meter scaled directly in megohm values. The current meter is placed in a series circuit composed of the power source and the resistance being measured.

Resistance read directly. An insulation tester gives a direct reading of the millions of ohms of resistance which any electrical insulation offers to the passage of current. Even good insulation does allow current to pass, if only on the order of 0.000001 (one millionth) ampere or less, per 500 volts of impressed test potential. It is this passage of minute current through insulation that causes the insulation

(Continued on Page 66)

About the Author

Richard W. Inman, vice president of Associated Research, Inc., was graduated from the University of Iowa with a B.S. in electrical engineering. He is a member of the American Institute of Electrical Engineers and the Instrument Society of America. Inman is a registered professional engineer in the states of Illinois and Iowa.

Listening for the pig approach. Pipeliner is careful not to get his ear too close to the 40 below zero steel. Steam heated metal buildings in the background house valves and metering runs that are sheltered to prevent freezing.

Pigging Gas Gathering System at 40 Below

Cold weather and hydrogen sulfide hazards call for special precautions in Westcoast's routine scraper runs through 20 and 26-inch sour gas lines.

By James Joseph
Los Angeles

DAILY PIGGING at 40 degrees below zero is wintertime routine for field maintenance men on Westcoast Transmission Company, Ltd.'s 150-mile Canadian gathering system. Sour gas distillates from some of the British Columbia wells may run up to 700 barrels per 50 MMcf of gas. Distillates are high in sulfide content analyzing about 4 percent hydrogen sulfide and almost as high in sulfur oxides.

Regular pigging is required on fully one-third of the gathering system. The 38-mile, 26-inch line gathering from the Buick Creek fields of British Columbia and a connecting 16-mile, 20-inch are pigged daily. Pigging is seldom necessary on two smaller, 12 and 18-inch gathering lines; line pressures up to 850 psig and gas flow carries sludge deposits out of these lines. Pressure in the two larger diameter lines now averages only about 450 pounds.

Pressure differentials of 20-25 psig are normally used across the pigs. With a pig velocity of about three miles per hour it ordinarily takes nearly 12 hours to clean the 26-inch line. During winter months the maintenance crews often launch and recover the pig during total darkness.

Special Clothing and Equipment Needed. The high hydrogen sulfide content of the gas and extreme cold calls for parkas, heavy mittens and gas masks. Turning valves at 30 to 40 degrees below zero can literally peel the skin from a bare palm in a hurry —heavy fur-lined mittens are a must.

Gas masks and portable oxygen bottles provide protection from the deadly H_2S fumes. Oxygen bottles contain about 40 cubic feet of air compressed to 2,500 psi; each one lasts about 20 minutes under constant use with physical exertion in the winter weather. Masks usually are worn at all times during the opening and closing of pig traps and while removing sludge. Ordinarily, the critical pig launching and recovery operation take only two or three minutes.

Permanent hoist frames are installed at each barrel.

Sour gas and extremely low temperatures are tough on pig rubbers; constant exposure to these conditions limit pig life to about three months of a daily cleaning schedule.

The McMahon gas processing plant at Taylor is located at the hub of the gas gathering system. It scrubs out the sulfur compounds and delivers sweet gas to the main 30-inch line. Some 300 million cubic feet a day is delivered through the 650-mile line between Taylor and Huntington near U. S. border. The gathering system terminates at Westcoast's Station 1.

As for pigging at 40 degrees below, Westcoast pipeliners now consider it routine. Said one, "After a while you don't even feel the cold. Besides where else can you shoot a moose 100 feet from the pig trap . . . in season."

—The End

Purging the trap. Crewman wearing gas mask for protection from hydrogen sulfide vapors heads for heated truck cab. VHF radio is used to coordinate pigging operations on Westcoast's gathering system.

Pigging crew chief checks line pressure as pig approaches barrel. A differential of about 20-25 pounds is used to move the pig through the 26-inch gathering line.

Above, masked crewman with oxygen bottle strapped on his back pulls the pig from the trap. Last trace of sludge is cleaned out of the barrel. Some of the sour gas supplied to Westcoast's British Columbia gathering system runs up to 700 barrels of distillates per 50 MMcf.

(Upper right) As two men pull pig from the barrel, one nearest the open trap still wears his gas mask. Oxygen bottles supply a 20-minute supply of fresh air to men working in the sub-zero Canadian winter weather. Teamwork during pig launching and recovery cuts working time to around three minutes.

(Right) Cleaning the sour distillate sludge from the barrel and sealing flange is important before closing the trap. Proper equipment and thorough preparations make Westcoast's winter pigging program pay dividends.

Panama, Inc. line-up gang completes climb over mountain west of Harrisburg, Penn. Welding gang completes filler passes in 20-inch pipe in valley below. Mountain terrain called for special design attention to wall thickness for high static heads.

Yard-coated pipe was laid on mountain spreads in central Pennsylvania. Here line-up gang completes stringer bead on joint at top of ridge. Tuscarora Mountain, one of the toughest obstacles overcome along on the pipe line route, is in the background.

Work moves ahead as . . .

Laurel Line Crosses Mountains, Rivers

Construction of this new products artery from Philadelphia to Cleveland speeds up after delay caused by unseasonally heavy rains.

By Melvin A. Judah, Editor, PIPE LINE INDUSTRY

CONTRACTORS laying the 440-mile Laurel Pipe Line Company products line are overcoming more than the usual number of obstacles to keep the line moving ahead toward fall completion. Unusually heavy rains early this summer along much of the right-of-way has been particularly costly; during one 31-day period in July and August, rain fell somewhere on the spreads on 29 days. Some of the roughest terrain in the eastern U. S., plus narrow right-of-ways through premium farm land and populated areas, a network of road crossings, and several wide and rocky river crossings has called for plenty of contractor ingenuity.

Pipelaying is now about half complete on the six sections of main line. Two of the most difficult "miles" of construction were the crossings of the Susquehanna River at Harrisburg and the Delaware River at Philadelphia. Pipe Line Construction and Drilling Company had to blast some 4,000 feet of rock in the Susquehanna; Missouri Valley Dredging Company pulled the 5,900 foot Delaware Crossing of 24-inch from a rail launchway keeping the concrete coated, pontoon buoyed pipe on the bottom while ships steamed above it in the channel.

All main line pipe is Grade 5LX-52 varying in wall thickness from 0.281 to 0.375 for the 24-inch, and from 0.210 to 0.250 for the 14-inch. Product static heads called for special attention to wall thicknesses in several of the mountain areas.

Some difficulty has been experienced with cracks in the stringer bead

Over-the-ditch coating on 24-inch section east of Harrisburg comprises a 3/32-inch system of coal tar enamel, glass wrap and asbestos felt. Additional protection was provided by rock shielding where limestone outcrops were cut by the ditch.

The 5,900-foot crossing of the Delaware River at Philadelphia was laid from rail launchway on east bank in two sections. Here a 2,900-foot section of 24-inch concrete coated pipe was pulled under the Delaware channel crossing by winch on the west bank as ship steams down channel. Another winch on east bank also assisted by pulling up trailing section on rail launchway. Pipe will be buried at a depth of 65 feet below mean high water level with 25 feet of cover in channel.

of the high test pipe, but close screening on welder's qualification tests to make sure of hiring a pipe line welder has enabled contractors to get better than average weld acceptance on X-ray inspection.

All pipe is being coated over the ditch with a $^{3}/_{32}$-inch coal tar, glass wrap, asbestos felt system except for the section between Mechanicsburg and Duncansville, Penn. stations. Panama, Inc., is laying yard coated pipe on this spread which crosses over the Tuscarora Mountains. River pipe was coated with asphalt mastic and up to 3¾-inches of concrete weight coating on the 24-inch Delaware crossing. Specifications call for jeeping of the coated pipe and protection with rock shielding in areas where the ditch cuts through limestone outcrops.

Cathodic protection will be coordinated with several adjacent lines including another in the same right-of-way. Upon completion the line is

Rubber-tired cradles just above high tide level are bolted to concrete pads. They support pipe with the correct overbend as it enters the water. Launching rails on "ties" extend some 3,000 feet back from the river bank.

Rail dollies are picked up from pit behind launching rollers. Dollies were taken back to the shore end of the launchway and set on rails to receive the second 2,800-foot string of pipe. Island of dredged spoil in Delaware River can be seen in the background. Material in the stream is to be dredged back over the pipe for backfill after completion of laying and testing.

Steel cable "zipper" that releases pontoons after pipe settles to bottom of river ditch runs along the pipe string. This cable is pulled from winch station to break pontoon lashing bands after pipe location has been confirmed by sounding. Each 43-foot joint weighed 29,000 pounds in air. River pipe was designed for a stabilized string in 90-pound per cubic foot mud.

"Come-along" winch pulls trailing section of 2,900-foot string. Giant pulling winch on far bank of river provided pulling power to overcome drag of river section of pipe string. Winch is anchored to driven pile dead man below. A constant check was maintained on cable tension by dynamometer secured to pulling cable at the right of the operator.

As end of first section of Delaware crossing approaches the river bank the second 2,900-foot section is snaked onto the launchway from skids on the right. After dollies were put under pipe and pontoons lashed on, it was pulled into the channel.

to be hydrostatically tested to 1,000 pounds per square inch.

Road Crossings Were Numerous. The Laurel right-of-way crosses the Pennsylvania Turnpike four times. Also, because many of the state and local roads follow the contours of the Appalachian Mountains cut by the pipe line route, there were many other road crossings to bore and case.

Adding to the contractor's problems were congested areas, industrial sites and valuable farm lands along the right-of-way. Many of these Pennsylvania farms are kept up to the appearance of a golf course, and choice grain and tobacco crops come high.

Contractors on the main line land work include Missouri Valley Dredging Company, 25.6 miles of 24-inch between Eagle Point, New Jersey and the Booth station in Delaware County, Penn.; Engineers Limited Pipe Line Company, 106 miles of 24-inch, from Mechanicsburg and Duncansville stations and 113 miles of 18-inch between Duncansville and Aliquippa; Williams Brothers is laying the 106 miles of 14-inch between Aliquippa, Penn., and Cleveland.

Pump Station Equipment. Construction is well underway on four main line pumping stations. Booth Station, the eastern terminal is located near Philadelphia. Deliveries will be received at Booth from Gulf, Sinclair and Texas Co. refineries nearby. Pumping equipment at Booth includes three 1,800 rpm, 3-phase induction motors (one 600 hp, one 1,000 hp, and one 1,750 hp) driving centrifugal pumps. Future plans include the addition of two 1,750 hp motors driving centrifugal pumps. Storage capacity at Booth station consists of 17 tanks.

The booster station at Mechanicsburg equipped with one 800 hp and two 1,500 hp, three-phase induction motors driving centrifugal pumps. Duncansville station has one 800 hp and two 1,250 hp units. Future expansion plans call for the addition of two 1,250 hp units at Duncansville and two 1,500 hp units at Mechanicsburg.

Aliquippa Station is the final booster station. Pumping equipment consists of one 1,250 hp main line unit and two 250 hp boosters. Storage is provided by 13 tanks. Booth, Mechanicsburg, and Aliquippa Stations are to be manned-automatic. Duncansville will be remotely controlled from the dispatchers board in Harrisburg. —**The End**

Reduced Electrical Equipment Downtime

(Continued from Page 59)

resistance tester to indicate. During the resistance test, the insulation path being tested (between the instrument leads) is subjected to a potential of 125 to 1,000 volts DC depending upon the range and type of test instrument being used. This voltage causes a current flow through the insulation and through the indicating meter of the tester which is calibrated in megohms.

Two main types of megohmmeters are in use today as preventive maintenance tools. One derives its test potential from a hand cranked generator and the other derives its test potential from a battery powered synchronous vibrator source. Vibrator-type instruments have proven to be more convenient since in addition to the megohm insulation resistance ranges and the normal circuit checking ohm ranges, both AC and DC voltage ranges are available. These added scales are of great value as all too frequently circuits or equipment about to be tested, while presumed to be dead, actually have operating voltages on them or to ground. Besides being very dangerous to the test man such conditions frequently damage the test instrument.

Resistance records necessary. Unlike voltage, circuit resistance or current flow which can be determined positively at any given time with proper instruments, insulation resistance values which are "safe" for any piece of equipment vary greatly. Two motors, for example, of the same horsepower, same make and same age may have quite different insulation resistance values, yet both be in safe operating condition. Therefore, insulation resistance tests can do the best preventive maintenance job only if records are kept on each piece of equipment tested; and if tests are made at uniform intervals under similar conditions of operation, temperature and humidity.

Charts easily read. An illustration of the value of insulation resistance records is shown in Figure 2. The first resistance record tells the story of a motor aging gradually and normally under good care. The insulation resistance readings were taken from the day of installation.

The card on the right tells a story of trouble. This motor performed satisfactorily for the first two years, when a preventive maintenance test showed a sudden drop in resistance value. Inspection showed a need for a new stator winding, and after it was installed, resistance values bounced back higher than the first readings taken. Similar "case histories" could be shown for cables, circuit breakers, transformers, insulators, switches, meters etc.

Safe operating resistances. Insulation resistance should be high enough to permit the equipment to operate normally without excessive current consumption or heating. This is the simplest, most obvious rule to follow. Generally, any insulation may be considered satisfactory in industrial equipment and circuits operating at 1,000 volts or less if its resistance exceeds one megohm at normal operating temperatures and humidities.

Carrying this safe minimum a bit further, the safe minimum for apparatus operating in excess of 1,000 volts is simply one megohm for every 1,000 volts or fraction thereof. For example, equipment operating at 2,500 volts, should have minimum resistance readings of 2.8 to 3.0 megohms. If initial insulation resistances fall below this minimum, the equipment should be taken out of service, inspected carefully, and necessary cleaning or repairs made to bring resistance values over the minimum reading suggested.

Inspection interval. Working electrical equipment such as motors, generators, transformers, heating elements, relays etc. is generally more likely to develop insulation failure than static equipment such as wiring, insulators and other non-moving, non-cycling apparatus. Therefore, schedules of periodic insulation resistance tests should include more frequent testing of the working equipment. Four to six months between tests is generally considered a safe interval. Some maintenance departments check all rotating machines every three months; and there are many motors operating in dirty or moist atmospheres which are checked monthly. Tests of wiring and like apparatus are usually adequate on a yearly basis unless working conditions are particularly bad. —**The End**

Rules of Thumb

and Engineering Data Sheets for the Pipeliner's field notebook

$25 for Engineering Data Sheet $15 for Rule of Thumb

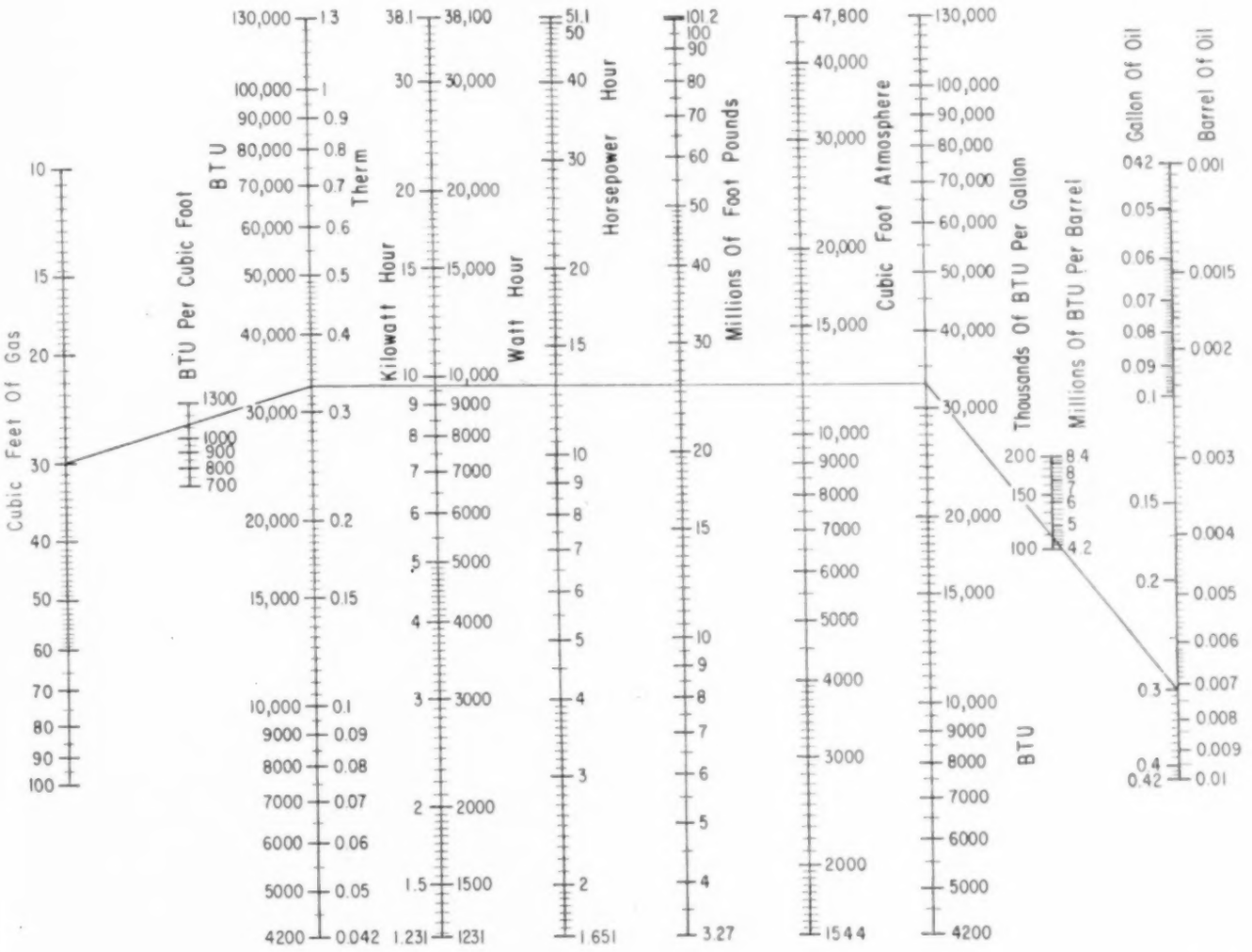
These practical aids give quick, reasonably accurate answers to design, maintenance and cost estimating problems. PIPE LINE INDUSTRY will pay $25 for each chart, nomograph or data sheet published—$15 for each Rule of Thumb. Send your ideas to PIPE LINE INDUSTRY, P. O. Box 2608, Houston, Texas

Engineering Design —53—Energy Conversion Chart

This monograph provides an easy method for determining the fuel requirements for various types of fuel. Since the Btu content per unit volume of natural gas and crude oil vary over a limited, but significant range of values, nomographs for the energy value of several gases and oils are included rather than using an average value.

Example: 30 cubic feet of a gas with 1100 Btu per cubic foot yields 33,000 Btu. Conversion of 33,000 Btu to the other units eof energy is obtained by drawing a straight line connecting the values 33,000 on two end Btu scales. Using the right-hand nomograph, an oil with 11,000 Btu per gallon (about 4.6 million Btu per barrel) will produce 33,000 Btu from 0.3 gallon (about 0.0072 barrel).

Idea submitted by Marvin H. Green, Philadelphia

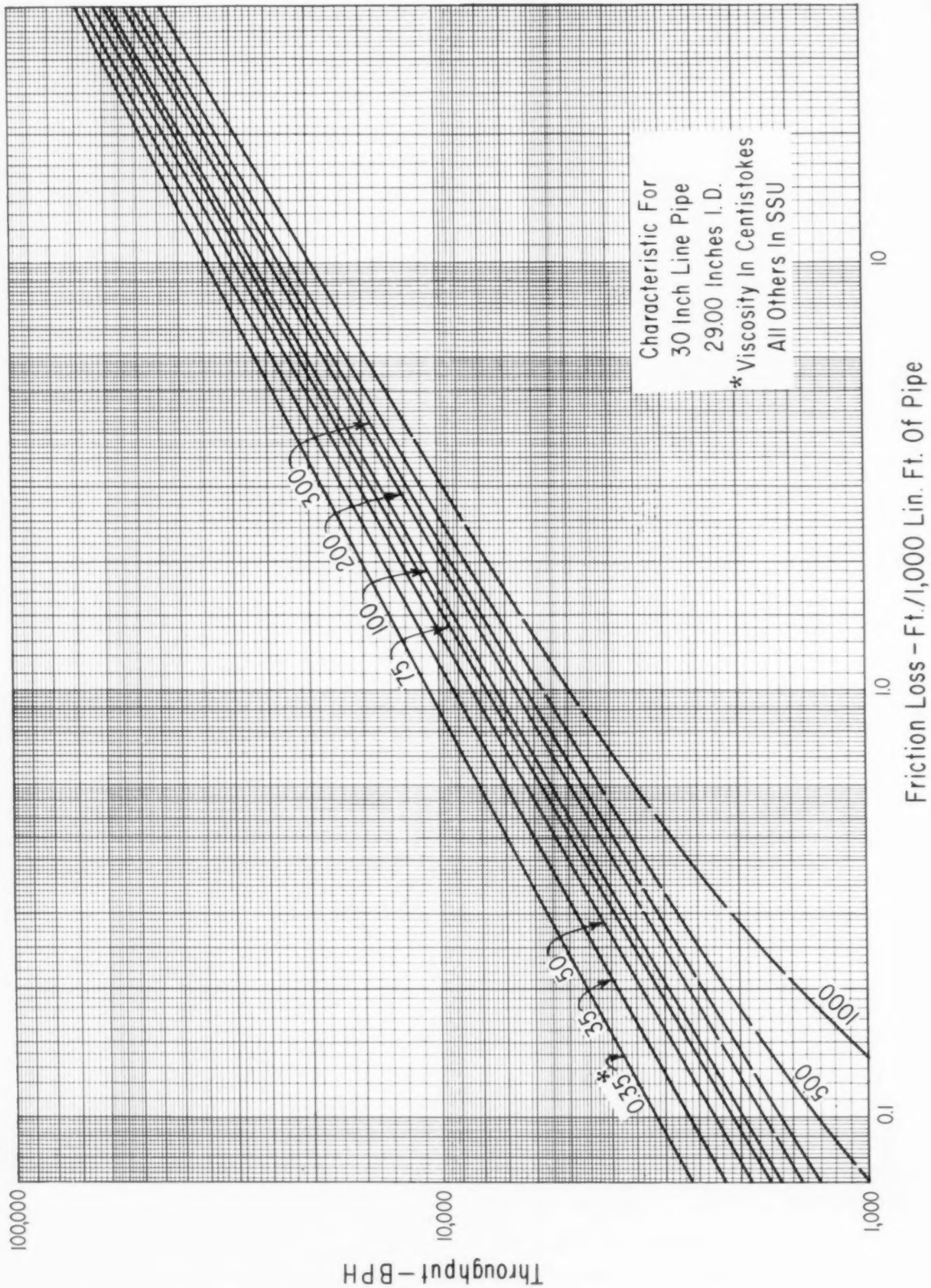


Engineering Design —54—Head Loss Charts for Various Sizes of Pipe

Friction Loss Characteristics for 30-inch pipe were computed by a pipe line company using data of the Hydraulic Institute. Use of these data in laminar and critical zones is adequate for estimates. Friction losses in transition and complete turbulent zones are very accurate.

(Chart 14 in a series of 19—30-inch line pipe)

ENGINEERING DESIGN 54



WHAT'S HAPPENING

IN PIPE LINE CONSTRUCTION

By Donald G. DePugh, PIPE LINE INDUSTRY Staff

North Carolina Awards Contract on Gas Line

North Carolina Natural Gas Company has let contracts on 200 miles of its proposed 600-mile main line gas system extending from a point near Mooresville, N. C. to cities on the eastern coast.

C. N. Flagg and Company will install 200 miles of lateral and intra-city lines in Wilmington, Fayetteville, Kingston, New Bern and Washington.

The $30 million project will consist of a 16-inch diameter connecting to Transcontinental Gas Pipe Line Corporation's main line in central North Carolina extending eastward to Fayetteville; a 10-inch line from that point northeast to Kingston, Washington and New Bern; and a 12-inch line extending from Fayetteville to Wilmington.

The system is expected to have an ultimate capacity of about 40 MMcf of gas daily. Tidewater Natural Gas Company, the utility company serving the area, has contracted Flagg for the installation of the inter-city lines. Transco's main line moves gas from Texas and Louisiana to the East Coast area.

Miss U.S.A. Dedicates Texas Eastern's Lebanon Terminal

Miss Eurlyne Howell, recently named Miss United States in the Miss Universe contest, takes a healthy swing with the champagne bottle during the dedication of Texas Eastern Transmission Corporation's new $2 million Lebanon, Ohio, terminal. H. M. McDonald, vice president and general manager of the company's Little Big Inch division, turned the valve to receive the first shipment of products. Others taking part in the special ceremonies inaugurating delivery of products through the converted Little Big Inch line were Capt. M. V. Carson, head of Oil and Gas division of Department of the Interior; Millard Neptune, senior vice president of Texas Eastern; Walter Guthrie, Detroit Division Manager of Socony Mobil Oil Company, who accepted the 50,000 barrel shipment of premium gasoline; J. W. Hargrove, financial vice president of Texas Eastern, and F. B. Neptune, vice president of Phillips Pipe Line Company. Lebanon terminal is the easternmost delivery point on the modernized system that now links Gulf Coast and Mid-Continent refineries with Midwest marketing areas. Texas Eastern is giving priority to plans for extending the line to the East Coast.

El Paso Plans 400-Mile Line to California

El Paso Natural Gas Company will construct a 400-mile, 34-inch gas line from a point south of Salt Lake City, Utah, to a point on the California-Nevada border near Las Vegas.

El Paso has entered into an agreement with Colorado Interstate Gas Company whereby it will purchase 200 MMcf of gas daily from Colorado to deliver to California. Another 200 MMcf per day will be supplied by Pacific Northwest Pipeline Corporation to enable El Paso to provide 400 MMcf of gas for the West Coast.

Colorado Interstate will lay a 140-mile line extending from a point south of Salt Lake City to Rock Springs, Wyo., to connect with its main line.

Ultimate capacity of El Paso's trunk line will be 700 MMcf per day. Plans also call for an additional 150 MMcf to be taken from Westcoast Transmission Company's Alberta sources. Westcoast has an application before Canadian government for authority to export gas to El Paso. West-

Gulf's Ostrica Terminal

Gulf Refining Company's newly-enlarged Ostrica Terminal is America's fastest-loading oil terminal. The terminal is located 75 miles below New Orleans on the Mississippi River. Crude is pumped to the supertanker from pancake type storage tanks and four pipe lines serving the Delta. Established in 1938 as a barge terminal, it can now load a supertanker, T-2 tanker and several barges at a rate of 10 million pounds per hour.

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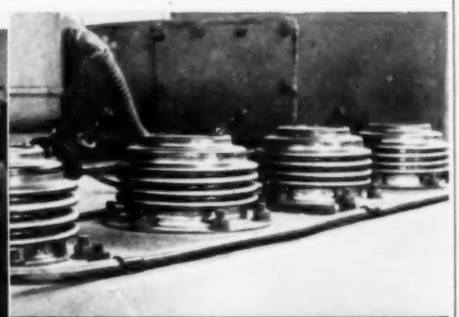
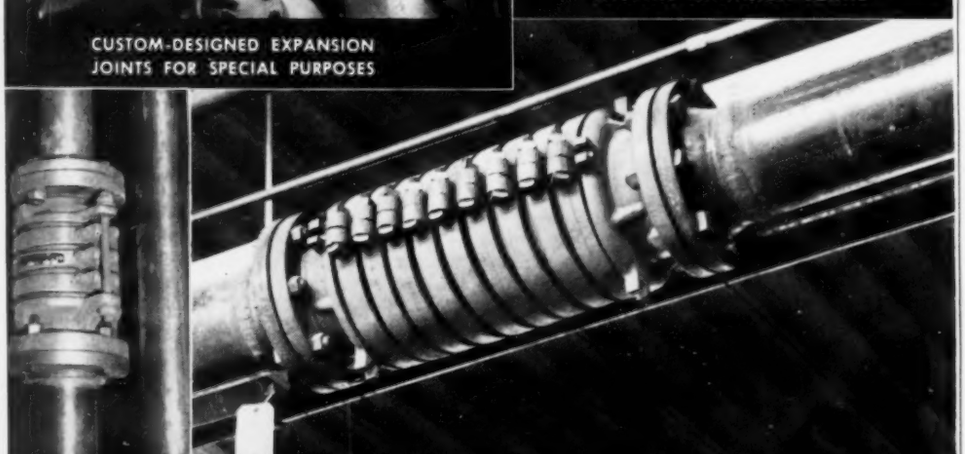


FREE-FLEXING PACKLESS EXPANSION JOINTS



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coast would deliver gas to Pacific Northwest at the Washington and British Columbia border.

Pacific Northwest and Colorado Interstate will supply gas to El Paso at Rock Springs, and from there it will be carried to California.

This proposal is a substitute for an earlier El Paso plan which included building a 500-mile line from Twin Falls, Idaho, to California. Pacific Northwest was to construct a 123-mile line from Spokane, Wash., to Kingsgate, Mont., where it would receive gas from a Westcoast line connecting to the Savanna Creek field in Alberta.

Contracts Awarded on Swan Hill to Edmonton Line

Federated Pipe Line Company, a subsidiary of Home Oil Company, has awarded contracts on its 120-mile, 10¾-inch crude line connecting Swan Hills field with Edmonton.

The northern section from Swan Hills to Assiniboine has been let to Mannix Co. Ltd. and the southern half from Assiniboine to Edmonton will be built by Bannister-Helm, Ltd.

With one pump station planned, initial capacity of the $6.5 million line will be 30,000 bbl. per day.

Pioneer Announces Plans For 62-Mile Gas Pipe Line

Pioneer Natural Gas Company announces plans for construction of a 62-mile, 10-inch, gas main line extending from Pampa to its main system near Canyon in Randall County, Texas.

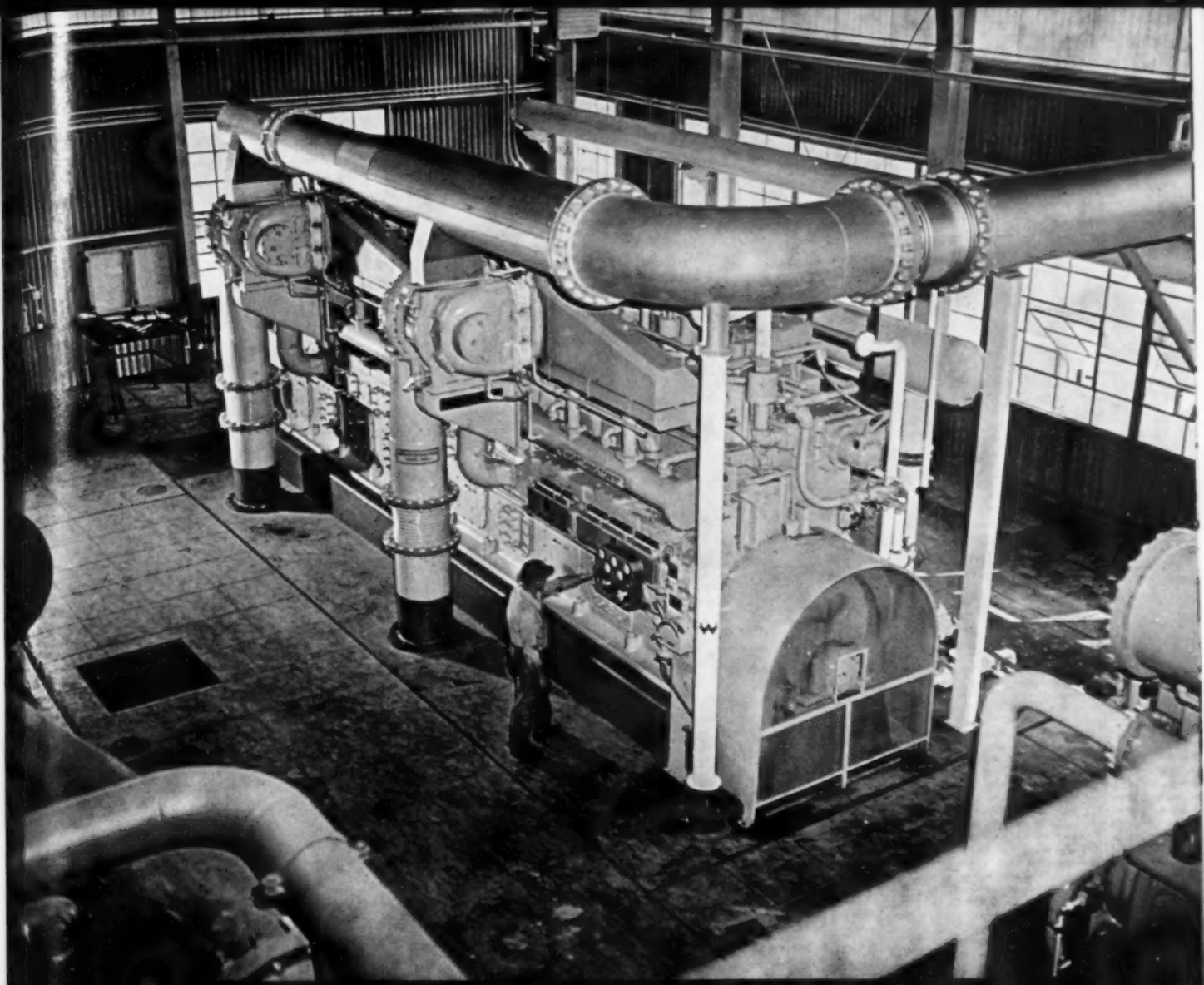
Twenty miles of small diameter gathering lines and a 4,000 horsepower compressor station will be included in the $4.5 million project.

The new facilities will add 25 MMcf of gas per day to Pioneer's system. The construction program is the first step in company's plan for 50 MMcf daily increase in capacity.

Michigan Wisconsin Lets Contracts for Station Work

Michigan Wisconsin Pipe Line Co. has awarded contracts for the construction of 10 compressor stations and expansion of five existing stations.

Ford, Bacon & Davis will install nine intermediate stations along its main line with 3,500 horsepower and one 3,500 hp station in Wisconsin. Construction is under way and should be completed by October.



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THE ONLY 2-CYCLE ENGINE COMPRESSOR WITH SELF-SUSTAINED TURBOCHARGING!

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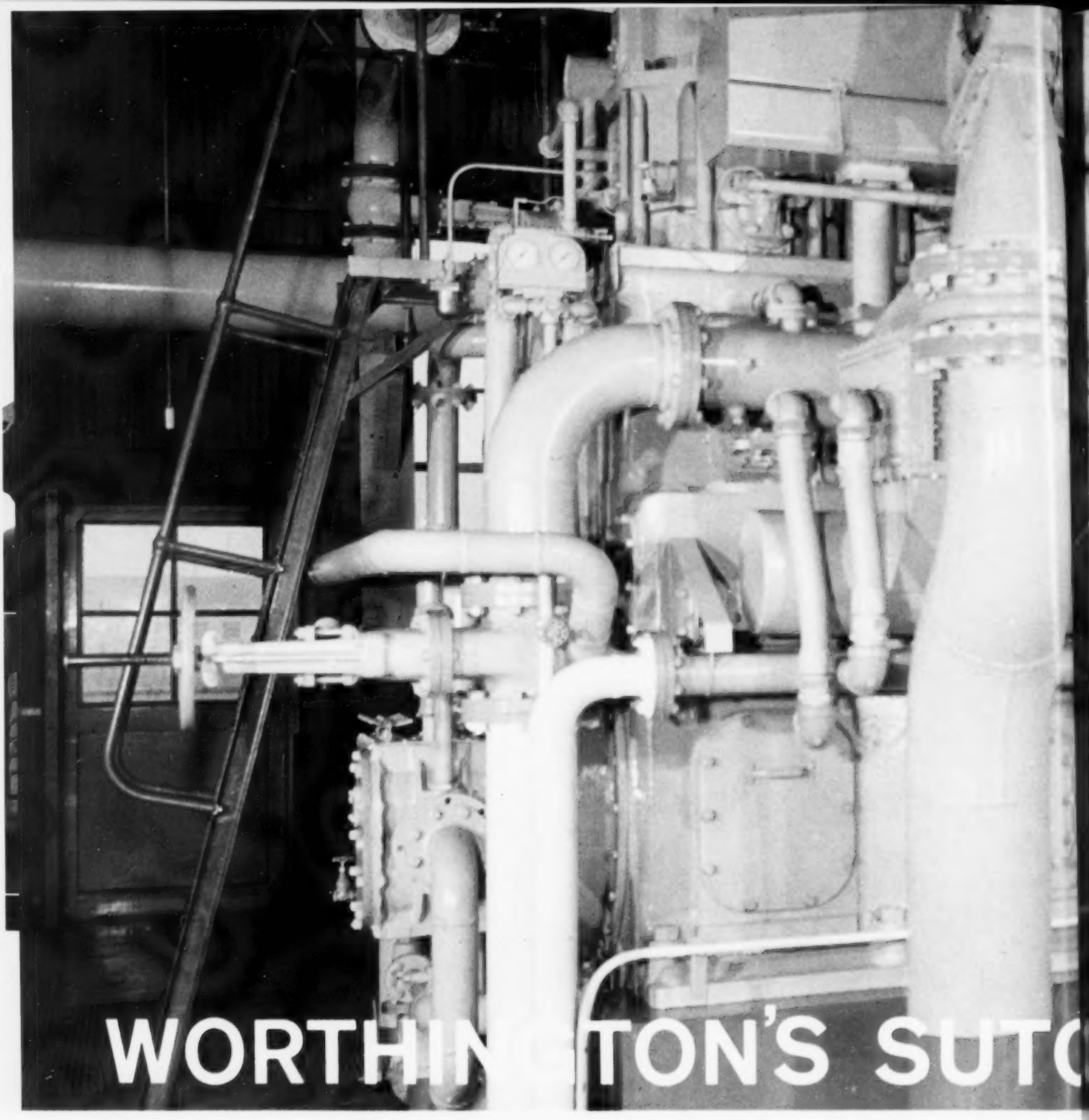

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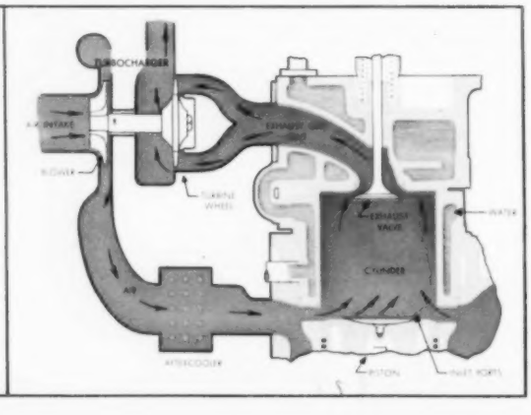
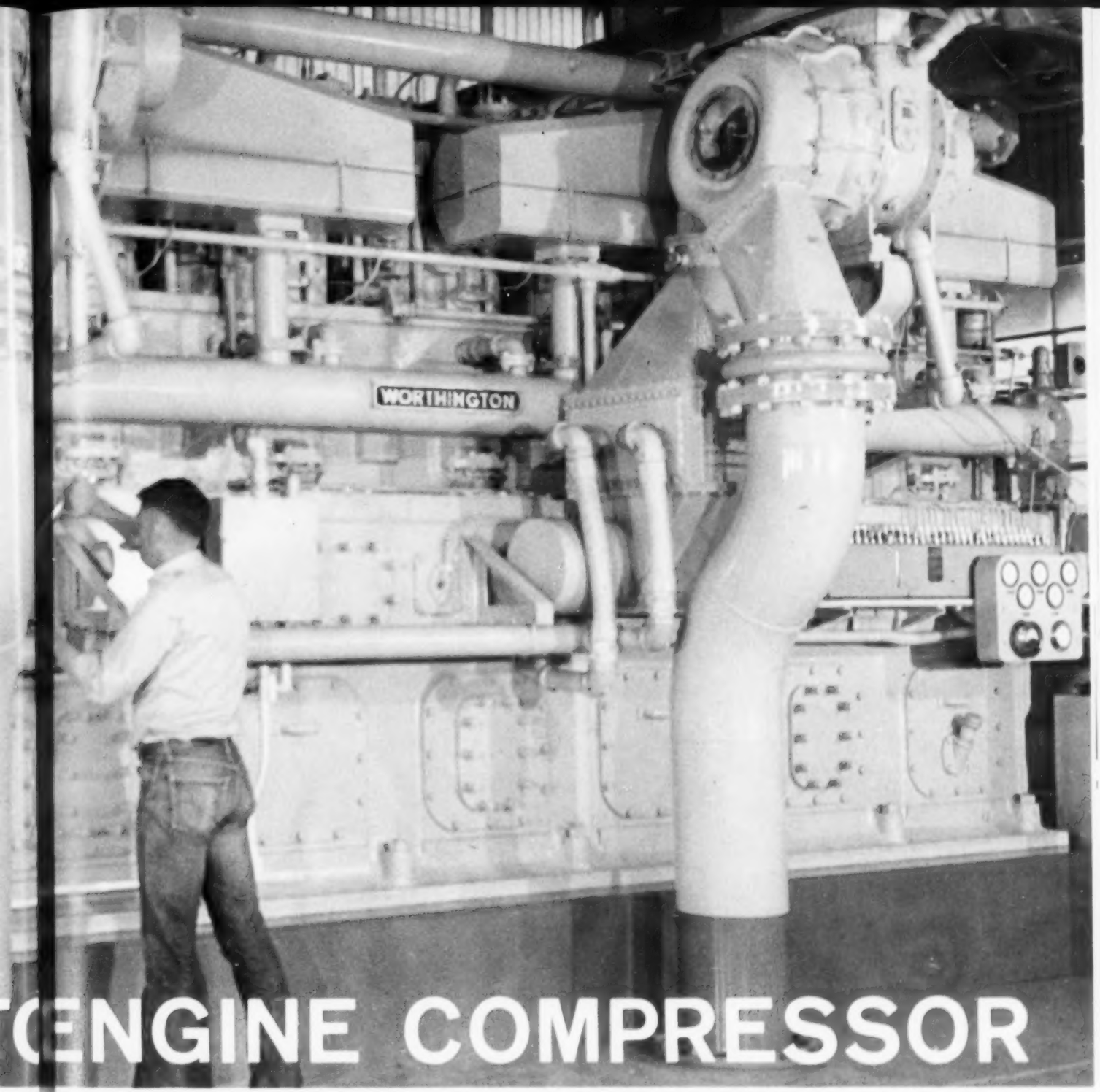
TURBO-UNIFLO OPERATION

Straight through flow of air in the cylinder, the large inlet port areas (full 360 degrees), and the timed exhaust valves give maximum scavenging effectiveness with optimum back pressure.



Compact, reliable, efficient—the unique SUTC gas engine compressor with independent turbocharging has quickly become the outstanding engine compressor on the market. (Today, SUTC engines are in operation in chemical, petro-chemical plants and in pipeline service throughout the world!) Thanks to the self-sustained turbocharging feature the SUTC develops almost double the hp in the same space required by a non-turbocharged engine. Further, the field-proved Worthington TURBO-



ENGINE COMPRESSOR

most flexible in operation

UNIFLO system provides the most complete scavenging, resulting in a complete absence of residual gases in the combustion chamber.

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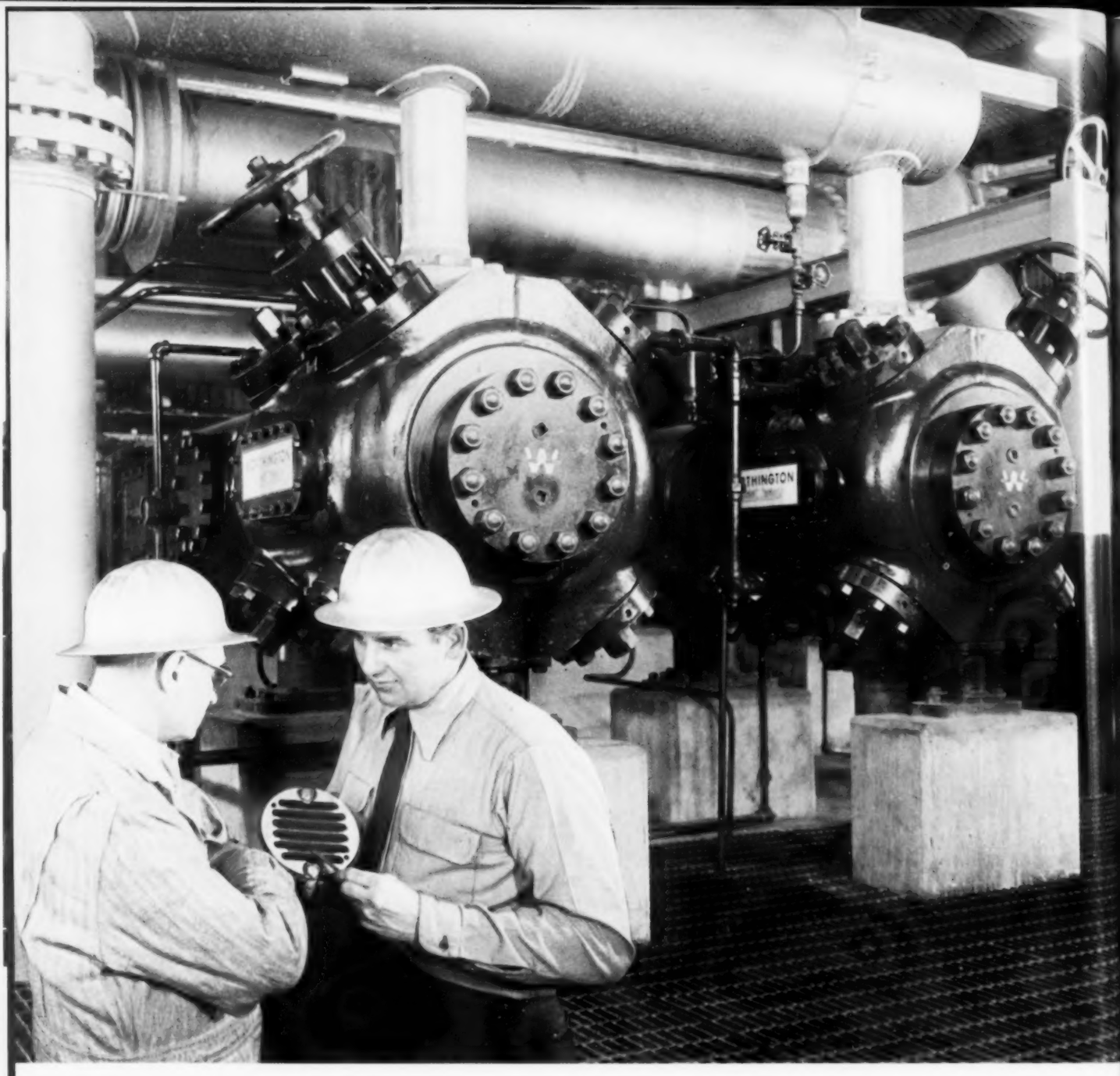
Economy—No engine compressor in this range is more economical. Low fuel consumption stems from the fact that sufficient exhaust gas energy is applied to give full turbocharged effect through *all* speeds and loads without added mechanical means for driving the supercharger.

Efficiency — Operating at relatively high compression ratio, the Turbo-Uniflo design affords much smoother combustion characteristics than other engines with lower compression ratios. This is due to the positively controlled timing arrangement, cylinder configuration and design of the exhaust manifolding.

For complete details on the SUTC turbocharged gas engine compressor, call your nearest Worthington District Office, or write: Worthington Corporation, Section 43-2, Harrison, New Jersey. In Canada: Worthington Canada Ltd., Brantford, Ont.

WORTHINGTON



compressor-user survey shows

FEATHER VALVE PREFERRED 2 TO 1!

FEATHER VALVE

VALVE A

VALVE B

A recent survey of compressor users put the amazing Feather* Valve first by far in all four operating categories —simplicity of construction, efficiency, low maintenance cost and quiet operation. In addition, the Feather Valve was picked as the preferred compressor valve 2 to 1 over the nearest competing type of valve!

The lightest, fastest-acting valve available, the amazing Feather Valve provides very sharp action with virtually no slip or back-flow. It works with no impact . . . has no buffer plates or cushioning devices. Practically indestructible it assures long life with negligible maintenance costs. When buying your next compressor, look into Worthington's complete line of Feather Valve units. Worthington Corporation, Harrison, N. J.

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WORTHINGTON

Coastal States Proposes 289-Mile Gas System in Texas

Coastal States Gas Producing Company proposes construction of a 289-mile gas system to take gas from southern counties in Texas for delivery to Texas Illinois Natural Gas Pipeline Company and Transcontinental Gas Pipe Line Corporation.

The $12 million system would take up 480 MMcf of gas daily from Hidalgo, Starr, Duval, Jim Hogg, Zapata, Webb and Brooks counties. Plans call for a 20-inch main line with 14-inch laterals.

The system originates in the McAllen area of Hidalgo County with one line extending through Starr County and northeast to the Falfurrias area. Another main line moves northwest from McAllen to Webb County and is joined by a 14-inch lateral from Lopena in Zapata County. From there it runs north into La Salle County. The lines tie in with Texas Illinois' line at Falfurrias and Transco's system at La Salle.

Coastal has filed letters of intent with the Federal Power Commission for approval to sell gas to the transmission companies.

Brown & Root Awarded Southern Natural Work

Southern Natural Gas Company has let more contracts on its construction program for South Louisiana. Brown & Root has been awarded 65 miles of various diameter offshore and marsh work.

Western Pipe Line, Inc. has an additional 57 miles of 6 through 10-inch.

Brown & Root will construct 16 miles of 20-inch, 14 miles of 16-inch, 25 miles of 12-inch, 2 miles of 8-inch, 12 miles of 6-inch and 6 miles of 4-inch.

Last month Southern awarded contracts on 516 miles of loops and laterals.

NACE San Joaquin Tour Set for September 24-25

The NACE San Joaquin Valley Corrosion tour will be held in Bakersfield, Calif., September 24 and 25.

Seven oil and gas companies have arranged displays, and on both days of the meeting a tour of corrosion exhibits will be made. A panel discussion will follow the tour. Fee for the conference is $15.

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Extra Strength

Double Convolute

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MOLDED PULL-ON CASING SEAL

The molded seal for **any job.** Double **accordion** design provides flexibility for eccentric installations, with plenty of room for longitudinal movement in **either** direction. Ribbed inner surfaces and stainless steel bands seal the rubber to the pipe to form an impervious joint. Maloney compounded rubber is extra thick at pressure and shear points eliminating the need for additional shielding. Long life, free from checking and other aging symptoms, is assured by production quality control of rubber compounding and molding. Installs with Stainless Steel banding for long life. Available immediately in the full range of size combinations.

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MODEL 58
FULL ENCIRCLEMENT CRADLE

The Cradle that supports the carrier **all the way around.** The Model 58 Centering Cradle is a double steel band with ribbed rubber lining to provide insulation and protect pipe wrap. Runners are steel and Neoprene, providing double insulation, **performance proven** in miles of crossings on the Model 55 Maloney insulators. Built-in tension in the cradle band holds it firmly in place during installation — without bolting. The Model 58 cradle is available in any combination of carrier-casing sizes to your specifications.

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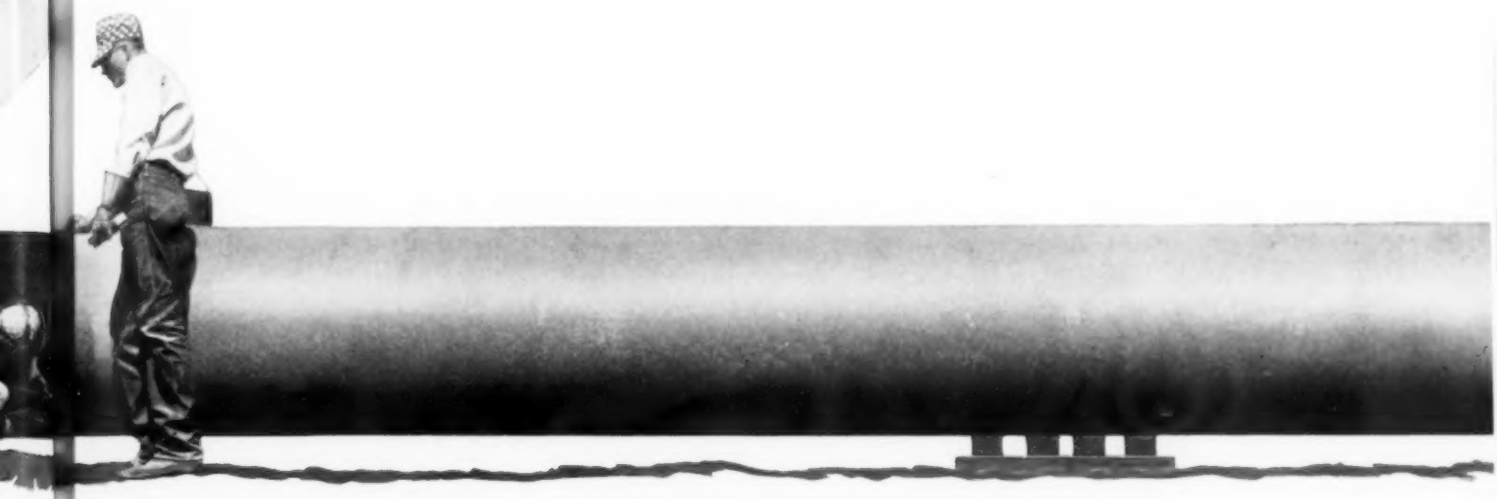

BETHLEHEM STEEL LINE PIPE—now produced to 42 inches OD—is manufactured to the specifications shown below.

	SIZES (in., OD)	WALL THICKNESSES (in.)	LENGTHS	SPECIFICATIONS
HYDRAULICALLY EXPANDED ELECTRIC FUSION-WELD (submerged arc)	22 and 24 26 through 36 36 through 42 ①	¼ to .0438 incl. ¼ to ⅝ incl. ① ¼ to ¾ incl. ①	40-ft ②	API 5LX, Grades X42, X46, X52 & X56 ①
ELECTRIC RESISTANCE-WELD	5 (nom) to 16	API	to 60-ft	API 5L, Grades A & B API 5LX, Grades X42 & X46
CONTINUOUS BUTT-WELD	½ to 4 (nom)	API	SRL 24 to 26-ft DRL to 50-ft	API 5L, ASTM 120; ASTM 53
COMPRESSOR STATION PIPE	in diameters, thicknesses, and lengths as required; fabricated from as-rolled, high-strength Mayari R steel; made in accordance with Sec. 8 of ASA B 31. 21.8—1955.			

① For sizes, thicknesses, and physical properties exceeding present API 5LX specifications, official API monogram cannot be applied.
② Expanded after two 20-ft lengths are joined with girth weld. ③ Also available in random lengths.

Let us quote on your requirements now. For early delivery, contact the Bethlehem sales office nearest you.

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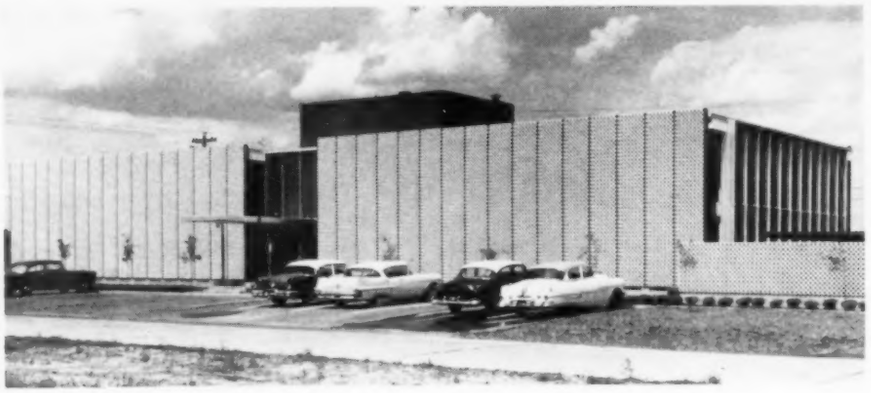

Pipe Line Technologists Moves Into New Offices

Pipe Line Technologists, Inc. recently moved into its new $350,000 office building in Houston. An unusual design of this 43 by 143 foot structure is its three glass walls and an outer solar screen constructed of clay conduit across the front and back of the building. The conduit wall serves as an aid in natural lighting effect and increases the efficiency of the air conditioning. Executive offices and Accounting department are located on the lower floor, and the upper floor is composed of Drafting department and engineering staff offices.

El Paso Lets Contracts On Several Gas Projects

El Paso Natural Gas Company has awarded contracts to R. H. Fulton & Company for construction of 133 miles of main and gathering lines.

R. H. Fulton will construct 63 miles of 16-inch and 13 miles of 20-inch line to connect the Aneth field with El Paso's San Juan line. Other spreads include 47 miles of 10, 12 and 16-inch commencing at Erick, Okla., and extending westward to a point near Shamrock, Texas; and 15 miles of 30-inch near Jal, New Mexico.

With construction already under way, completion is expected by October.

The $14 million project connecting Aneth with the company's main line is part of El Paso's construction program to deliver 100 MMcf to markets in California.

Jayhawk Pipeline Co. May Expand Crude System

Jayhawk Pipeline Company is considering expansion of its crude system in Kansas with construction of 140 miles of 6-inch feeder lines.

Extending west from its Meade County terminal, a 90-mile line would run to the Interstate field in southwestern Morton County bordering Colorado and Oklahoma Panhandle. The second lateral would be laid northwest to tap the Pleasant Prairie field in northwestern Haskell County.

Construction of the new lines would cost approximately $2 million.

Pacific Northwest Awards Contract to R. H. Fulton

R. H. Fulton & Company has been awarded contract by Pacific Northwest Pipeline Corporation for construction of 50 miles of 30-inch gas lines between Opal and Big Piney, Wyo.

Construction will get under way before September 15.

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PROPOSED PIPE LINE CONSTRUCTION

Here in convenient summary form is Pipe Line Industry's listing of company, line size, length, service, location and project status.

U. S.

Chicago District Pipeline Company, 52 miles, 30-36 inch, gas, from Natural Gas' proposed line at Joliet to Chicago, $13 million, before FPC.

Coastal States Gas Producing Co., Corpus Christi, Texas, 45-mile, gas gathering system in Bee County, Texas to connect with Texas Eastern's main pipe line, $1 million, planned.

289 miles, 14 and 18-inch main line and gathering system, McAllen to Falfurrias, Tex., area, and Lopena to La Salle County, $12 million, planned.

Coastal Transmission Corp., Houston, 574 miles, 22-24 inch, gas, from McAllen, Texas to Baton Rouge, La. connection of Houston, Texas Gas and Oil plus 414 miles of laterals, $55 million, contracts let on compressor stations to Gasoline Plant Construction Corp.

Colorado Interstate Gas Co., Colorado Springs, 140 miles, gas, main, Salt Lake City to Rock Springs, Wyo., planned.

Conn-Mass Pipe Line, Inc., Orange, Conn., 88 miles, 8 inch, products, from Boston to Springfield, Mass., considered.

133 miles, 16-inch, products, from Linden, N. J. to Hartford, Conn., considered.

62.2 miles, 8-inch, products, from New Haven, Conn. to Springfield, Mass., considered.

38 miles, 6-inch, products, from Waltham, Mass. to Fitchburg, Mass., considered.

Consumers Power Co., 45 miles, gas, main line, from Woodbury station to Laingsburg Junction, Mich., planned.

126-miles, 26-inch, gas, main, Michigan-Indiana border to Plymouth, Mich., planned.

Deep Rock Gas Co., Oklahoma City, 120 miles, 6-inch, LPG, from Tioga, N. D., to Canadian border, planned.

El Paso Natural Gas Company, El Paso, 216 miles, 26 to 34-inch main line, 533 miles, 6-20-inch laterals, gas, 86,750 compressor hp; 126 miles, 30-inch main line, 266 miles, laterals, gas, 28,920 compressor hp in new and existing stations in Arizona, New Mexico and Texas, contracts let on 819 miles to R. H. Fulton & Co., McVean & Barlow, Inc., Western Pipe Line, Inc., Eastern Pipeline Contractors, and Engineers Limited Pipeline Co.

400 miles, 34-inch, Salt Lake City, Utah, to California border, planned.

Emerald Pipe Line Corp., 195 miles, 6 inch, products, from Tucumcari, N. M., to Albuquerque, N. M., planned.

Equitable Gas Company, Pittsburgh, Penn., 11.7 miles of storage pipe line and other facilities, $2,091,430, authorized.

Everglades Pipe Line Company, Miami, Fla., 35 miles, 10-inch, products, Port Everglades to Miami International Airport, $2.5 million, planned.

Gillette Pipeline Co., Cheyenne, Wyo., 103 miles, crude, from Dead Horse Creek field to Casper, Wyo., planned.

Great Northern Railway, St. Paul, 400-600 miles, 12-20 inch, crude, from Williston Basin to St. Paul-Minneapolis and Duluth-Superior areas, considered.

Gulf Interstate Gas Co., Houston, 12.8 miles, 6 and 20 inch, gas, loop line in Louisiana, $730,000, authorized.

Gulf Pacific Pipe Line Company, 1,600 miles, 30-inch, gas, Louisiana to California border, considered.

Gulf Resources, New York, 125 miles, gas, gathering system, from Lopena area in Zapata County to a point in La Salle County, Texas, planned.

Harry Bass & Sons, Inc., Dallas, gas gathering lines, Pembina field, Alberta, $17 million, approved.

Humble Oil & Refining Co., 250 miles, 26 or 30 inch, gas and 116 miles, main gathering system, varying sizes, from southwest Texas to Houston, plus gas processing and cycling plant near Corpus Christi, $75 million, planned.

Iron Ranges Natural Gas Co., 115 miles, gas, from Itasca and St. Louis counties along route of Mesabi range from Grand Rapids to Aurora, Minn., $5 million, before FPC.

Jayhawk Pipeline Co., 140 miles, 6-inch, crude, from Meade County to Haskell and Morton counties, $2 million, considered.

Katy and New York Central Railroads, 2500-mile, 10-12 inch, LPG, from Houston, Texas, to New York, considered.

Kerr-McGee Oil Industries, Inc., 24 miles, 4 inch, gas, to connect wells with its Breton Sound production island off the Louisiana coast, authorized.

Magna Pipeline Co., 40 miles, gas, underwater line from Anacortes, Wash., to Victoria, B. C., $6 million, planned.

Manufacturers Light and Heat Co., Pittsburgh, Penn., 21-miles, gas facilities in Pennsylvania and West Virginia, $1 million authorized.

34-miles, 20-inch, in Greene, Adams, and York counties, Penn., authorized.

Michigan Gas Storage Co., Jackson, Mich., gas, facilities in central Michigan, $2 million, authorized.

Michigan Wisconsin Pipe Line Co., Detroit.

102 miles, 4- to 20-inch, gas lines to connect new gas supplies in Laverne field, Oklahoma, contracts let to Brodie Construction Co.

25.3 miles, 12-inch, lateral loop, in Wisconsin, contract let to G. E. T. Construction Co.

20.5 miles, 24-inch, main line loop in Michigan, before FPC.

Midwestern Gas Transmission Co., Houston, 2067 miles, 3—24-inch, gas, from Emerson, Manitoba to Portland, Tenn., Michigan, before FPC.

Mookl Chemical & Gas Corp., Tulsa, and **Missouri Transmission Corp.**, Springfield, Mo., 425 miles, 16-inch, gas, from Oklahoma City area to St. Louis, before FPC.

North Carolina Natural Gas Corp., 630 miles, 2-16 inch, from Transco's system near Mooresville across to southeastern North Carolina, $30 million contracts let on 200 miles to C. N. Flagg & Company.

Northern Illinois Gas Company, 140 miles, 24-inch, gas, main line, East Dubuque to Des Plaines, Ill., planned.

Northern Natural Gas Co., Omaha, 167 miles, 20 inch, gas, from Farmington, Minn. to Duluth, Minn., and Superior, Wis., $12 million, before FPC.

42 miles, 10 inch, gas, from Rochester, Minn. to Winona and Goodview, Minn., $963,000, before FPC.

365 miles, gas, new facilities in Minn., Iowa, S. D., Neb., Wis., plus 1090 miles of branch line and station facilities, $65.7 million, authorization for a part. Gas facilities in Texas, Oklahoma and Kansas, $6 million, before FPC.

454 miles, main line loops and extensions, 6-30-inch, main line from St. Cloud, Minn., to Grand Forks, N. Dak., also 1,490 miles of branch lines, 2-10-inch, and station additions totaling 32,000 horsepower, $86 million, planned.

27.6 miles, 30-inch, gas, loop; 18.3 miles north of Beaver station in Okla., 9.3 miles north of Sunray station in Texas, $3 million, authorized.

Northern Utilities Co., 35 miles, 16 inch, gas, in Fremont Natrona County, Wyo., area; 8 miles, 12 inch, around Casper; 6 miles, 8 inch, from Sand Draw gas field to Beaver Creek field; 12 miles, 6 inch, from Beaver Creek field to the system servicing the Riverton-Lander area, planned.

Ohio Fuel Gas Co., 51 miles, gas, main lines, in Belmont, Carroll, Cuyahoga, Fairfield, Logan, Lorain, Marion, Muskingun, Stark and Wayne counties, Ohio, $2.2 million, authorized.

Natural gas storage field in Medina County, Ohio, 12 miles, 4½ to 20-inch, gas, $5 million, authorized.

Pacific Gas & Electric Co., 1300 miles, 30-inch gas, from Alberta, Canada to Antioch, Calif., $380 million, planned.

Pacific Lighting Gas Supply Co., 128-mile, 34-inch, gas, main line from Topock, Ariz. to Newberry, Calif., planned.

Pacific Northwest Pipeline Corp., Salt Lake City, 235 miles gas, gathering lines in San Juan Basin, Garmesa, Piceance Creek, and Big Piney Fields, $13.5 million, planned.

65 miles, gas, sales laterals in Washington, $1.5 million, planned.

52 miles, 30-inch loop Big Piney, Wyoming, gathering system, $5 million,

contracts let to R. H. Fulton & Company.

Pennsylvania Gas Co., Warren, Penn., 38 miles, 8 and 10 inch, gas, in Erie and Warren Counties, Penn., and Chautauqua County, N. Y., $2.6 million, authorized.

Piedmont Gas Co., Hickory, N. C., 78 miles, 2-8 inch, gas, from connection with Transcontinental Gas Pipe Line to serve customers in North Carolina, $2.6 million, authorized.

Pioneer Natural Gas Co., Amarillo, Texas, 62 miles, 10-inch main, Pampa, Texas, to Canyon, in Randall County, Texas, 20 miles, small diameter, gathering, 4,000 h.p. stations, $4.5 million, planned.

Phillips Petroleum Co., 25 miles, 6 to 20-inch, gas, South Eunice, New Mexico area, planned.

52 miles, 4 to 20-inch, gas, Gaines County, Texas, planned.

44-mile, 6-inch, products line, from Rocky pump stations to Amarillo, Texas, planned.

Plantation Pipe Line Company, 48-mile, 4-inch, products, between Bremen and LaGrange, Ga., $1 million planned.

Service Pipe Line Company, Casper, Wyo., 4,000 compressor hp at Herndon, Kans., 2,000 compressor hp at Scranton, Kans., and 2,000 compressor hp at LaGrange, Wyo.; additional 2,000 hp at Laton station, Rocks County, Kans., 2,200 additional hp at Elk Basin, Kirby, Owl Creek, and Lost Cabin stations, north of Casper, Wyo., planned.

Shell Pipe Line Corp., Houston, 100 miles, 18-20 inch, crude, Southwest Pass to Norco Refinery near New Orleans, $10 million, contract let to Houston Contracting Co. on 62 miles.

43 miles, 8-inch, crude, main, and 20 miles, crude gathering, Colorado City, Texas, to Borden-Garza County of West Texas, planned.

Southern Kansas Pipe Line Co., Inc., Arkansas City, Kansas, 200 miles, 6-10 inch, crude, southwestern Kansas to Arkansas City, Kansas, planned.

Southern Natural Gas Company, Birmingham, 136 miles, 24 and 26 inch; 215 miles, various diameter supply lines; 3,650 additional compressor horsepower to White Castle and Toca Stations; 8 miles, 20-inch loops; 660 hp Franklinton station, and 23 measuring stations. $40 million, contracts let to William Brothers, Western Pipe Line, Inc, and River Construction Corp. on 183 miles.

458 miles, 16-24-inch, loop lines, gas, between Gwinville, Miss., and Wrens, Ga.; 62 miles, 14-inch, loops, along Atlanta-Macon line; 53 miles, 6⅝ to 14-inch, loops, along various branch lines. 3,140 additional hp at Gallion and Elmore, Ala. and Wrens, Ga. 60 miles, 20-inch, loops, in Louisiana between Franklinton and White Castle and South of Toca. Lateral lines south of Gwinville and west to Cranfield field. 8,720 hp added at Franklinton, White Castle, Patterson and Brookhaven. $65 million. contracts let to River Construction Corp., H. C. Price, and Houston Contracting Co. on 333 miles.

Tennessee Gas Transmission Co., Houston, 264 miles loop lines in Tennessee, Kentucky, West Virginia and Pennsylvania, FPC Examiner authorization.

Compressor stations in Mississippi, Tennessee, New York, Pennsylvania and additions in Tennessee, Kentucky, Ohio and Pennsylvania, $129 million, temporary FPC Examiner authorization.

21 miles, 16-inch, 2 miles, 12¾-inch, gas, Louisiana coast, Vermillion, Blocks 46 and 64, $2.9 million, before FPC.

Texas Eastern-Penn-Jersey Transmission Corp., Shreveport, La., 65 miles, gas, from Delmont, Penn., to Lambertville, N. J., before FPC.

24,000 compressor hp additions to existing stations, $4.4 million, temporary FPC authorization.

4,000 horsepower to its Delmont, Penn., compressor station, five new compressor stations in Pennsylvania with total capacity of 67,000 hp, $11.2 million, authorized.

Texas Eastern Transmission Corp., Shreveport, La., 267 miles, 14-30 inch, gas, Louisiana, Mississippi, Pennsylvania and New Jersey, $50 million, before FPC.

96.5 miles, 30-inch, gas, between Kosciusko, Miss., and Uniontown, Penn.; 9.4 miles of supply laterals; a 10,250 hp compressor station, and 33,360 hp to existing compressor stations, $24.5 million, authorized.

141,780 additional horsepower in existing stations, a new 2,200 hp compressor station, in Louisiana, Mississippi, Pennsylvania, Ohio, Kentucky and Tennessee, authorized.

Texas Eastern Transmission Corporation and Wilcox Trend Gathering System, Inc., gas, compressor stations, $4 million, authorized.

Texas Gas Gathering Corp., Shreveport, 36.6 miles, gas, gathering system in Rodney Field, Jefferson County, Miss. and from North and South Locust Ridge, Lake St. John Field in Tensas and Concordia parishes, La., $855,413, before FPC.

Texas Gas Transmission Corporation, Owensboro, Ky., 92 miles, 30-inch, 19 miles, 26-inch, and 15 miles, small diameter, loop portions of system in Louisiana, Arkansas, Mississippi, Kentucky, Indiana and Illinois; additional horsepower at Pineville, La., Kenton, Tenn., Calvert City, Ky., Slaughters, Ky., Dillsboro, Ind., and Petersburg, Ind., totaling 9,040 hp. $20 million, before FPC.

Texas Illinois Gas Pipeline Company, Chicago, 16,000 additional hp to stations at Lufkin, and Marshall, Texas; Texarkana, Malvern, Searcy, and Biggers, Ark.; Jackson, Mo.; and Hammond, Ill., $3.9 million, before FPC.

Transcontinental Gas Pipe Line Corp., Houston, 204 miles, 36-inch, 107 miles, 30-inch, main line loops in 10 states; 3 intermediate stations: North Carolina, Virginia, Pennsylvania; 2,500 additional hp at six compressor stations; 164 miles, 24-inch from Leidy storage Penn.; 29 miles, 30-inch, New Jersey; gathering lines, Louisiana, 119 miles; 10 meter stations; additions to West Cameron and High Island area, 35-miles, 16-inch, 26 miles, 10-inch, and three gathering meter stations; 45 miles, 16-inch, purchase laterals and 5 meter stations, Louisiana; 67 miles, 10, 12, 20-inch miscellaneous transmission purchase laterals in Texas and Louisiana, 3 meter stations; 51 miles, 36-inch and 1 mile, 30-inch in New Jersey; 51 miles, 10- and 14-inch and 3 meter stations, southeast Louisiana (mainly offshore), $137.3 million FPC Examiner approval.

151 miles, 24-inch, 12 meter stations, southeast Louisiana, $14.5 million FPC Examiner approval.

2,500 additional hp at four compressor stations, St. Francisville, La.; Laurel, Miss.; Linden, Ala. and Wadley, Ala., $3 million FPC Examiner approval.

Wells, pipe lines, measuring equipment, stations at Leidy storage in Pennsylvania, $12.5 million FPC Examiner approval

Trans-Utah Pipeline, 120 miles, 16-inch, gas main line from Uinta Basin to Salt Lake City, considered.

Transwestern Pipeline Company, Houston, 1,305 miles, 24- and 30-inch, gas, main line, from West Texas and Oklahoma-Texas Panhandle area to Topock, Ariz., $193 million, before FPC.

Trunkline Gas Company, Houston, 204 miles, 26-inch, gas, main line from Tuscola, Ill., to Michigan-Indiana border; 464 miles, 30-inch loops between Longville, La., and Tuscola and 45 miles, 24-inch, in Texas, 183 miles gathering, Louisiana, 3000 additional hp at Longville station, $81.5 million, before FPC.

Underground Storage & Exploration, Upper Darby, Penn., 394 miles, 12-inch LPG, from Moundsville, W. Va. to Newark, N. J., $9 million, approved.

95 miles, 6-8 inch, laterals to Mauch Chunk, Penn., and to Philadelphia, planned.

United Gas Pipe Line Co., Shreveport, La., 203 miles, 30-inch, gas, between New Orleans and Mobile, Ala., $33.7 million, authorized.

International

ACT Oils, Ltd., Montreal, 400 miles, crude, Dawson Creek, B. C., to Bella Coola, B. C., before B. C. government.

Alaska-Yukon Refiners and Distributors, Ltd., Edmonton, Alta., 150 miles, products, serving Alaska and Yukon territory, $3.5 million, planned.

Bituminous Oil Pipeline Co., Calgary, 250 miles, crude, from Athabasca tar sand plant in northeastern Alberta to Edmonton, approved.

British Petroleum Co., 60 miles, crude, from deep water tanker terminal at Milford Haven, U. K. to Llandarcy Refinery, $18 million, planned.

Burmah Oil Co., Ltd., 850 miles, crude, 20 inch, from Nahorkatiya to Calcutta, India, planned.

Consolidated Gathering Systems, Ltd., Calgary, 198 miles, crude, Sturgeon field to Edmonton, planned.

Development and Resources Corp., 70 miles, 8 inch, gas, from Agha Jari oil field to Ahwaz, Iran, planned.

Elburz Oil Corp., 1000 miles, crude, from Central Iran to Alexandretta, Turkey, $450 million, planned.

Entre Nazionali Idrocarburi, Rome, Italy, crude, from Qum field in Iran to the Mediterranean Sea, considered.

Federated Pipe Lines, Ltd., 125 miles, 10¾-inch, crude, main line, from Swan Hills area of Northern Alberta to Edmonton, contracts awarded to Mannix Co. Ltd., and Bannister Helm Ltd.

Foothills Pipe Line, Ltd., 500 miles, 12 to 16-inch, LPG, from Alberta to Pacific Coast, $80 million, considered.

Hydrocarbons Pipeline, Ltd., Winnipeg, Manitoba, 880 miles, 6-8 inch, products, from Edmonton to Winnipeg, $35 million, partial authorization.

Independent Pipe Line Co., 2,019 miles, 34-36-inch, crude, Edmonton to Montreal, 23,000 pump horsepower, $395 million, before Borden Commission.

Interprovincial Pipe Line Company, 350-mile extension from Toronto to Montreal, looping line from Edmonton to Toronto, crude, $240 million, considered.

Mid-Continent Pipe Lines, Ltd., 1500-mile, 30-inch crude, Edmonton to Chicago, planned.

National Iranian Oil Co., 146 miles, 6 inch, crude, from Azna to Isfahan, Iran, $5 million, planned.

1000 miles, 38 inch, crude, from central Iran to the Turkish Mediterranean coast, considered.

Peace River Oil Pipe Line Co., Ltd., 70-mile, crude, Swan Hills to Iosegun Junction, approved.

Petroleos Mexicanos, 108 miles, 10 inch, gas, from Gral. Escobedo to Monclova to tie into Reynosa-Monterrey gas pipe line, $9 million, planned.

600 miles, 24 inch, gas, from Pemex City to Mexico City, $50 million, planned.

38 miles, 4 inch, products, from Mexico City to Toluca, $500,000 planned.

126 miles, 4, 6 and 8 inch, products, from Mexico City to Cuernavaca and Puebla, $2.5 million, planned.

Sui Gas Transmission Co., Multan, Punjab, India, 145 miles, 8-inch, gas, from Sylhet to Dacca, East Pakistan, $9 million, considered.

130 miles, 16-inch, gas, main line, Multan to Lyallpur, planned.

Trans-Europe Pipe Line, 700 miles, 30 inch, main trunk, crude, from Mediterranean to northern Europe, considered.

Westcoast Transmission Company, Ltd., 174 miles, 30-inch, gas, Savanna Creek gas field, Alberta, to British Columbian border, $45 million, planned.

650 miles, crude, from Peace River area to Vancouver, $100 million, planned.

Williams-McWilliams Industries, Inc., New York, 441 miles, 6-inch, crude, Villa Montes, Bolivia to Villa Hayes, Paraguay, considered.

Yacimientos Petroliferos Fiscales, Buenos Aires, Argentina, 621 miles, 12-inch, products, Mendoza to San Lorenzo, Argentina, $19 million, planned.

281 miles, 12¾ inch, crude, Pichanal to San Miguel Tucuman to Techint, S. A., planned.

450 miles, 16-inch, crude, from Neuquen Province to Bahia Blanca, planned.

Magnolia Pipe Line Company To Install Microwave System

Motorola Communications & Electronics, Inc. has been awarded contract by Magnolia Pipe Line Company to install a microwave system extending from Dallas to Beaumont, Texas.

The 267-mile network, scheduled for completion by January, 1959, will be used to remotely control pumping operations at pipeline stations along the route. Twelve voice channels providing voice and telemetering facilities will be utilized initially.

NGPL, Colorado Interstate Cancel Beatrice Project

Natural Gas Pipeline Company of America and Colorado Interstate Gas Company have canceled the proposed Beatrice pipeline construction project.

The project would have enabled NGPL to supply an additional 485 MMcf of gas daily to Chicago and other Midwest markets. The proposed expansion was filed with the Federal Power Commission in 1957, but the expected certification from the FPC was stalled by the Memphis Decision last November.

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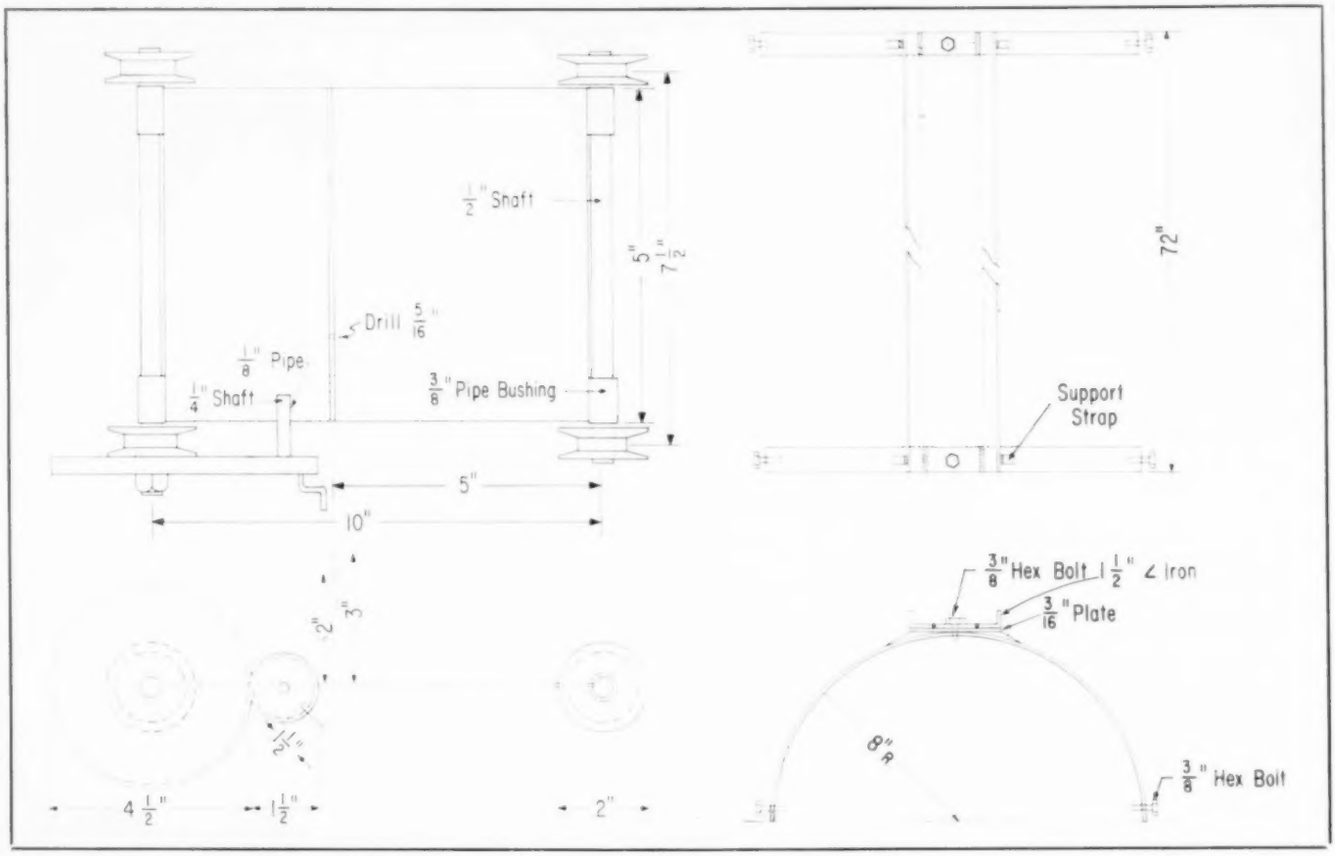
How to do it

PIPE LINE HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, PIPE LINE INDUSTRY, P. O. Box 2608, Houston 1, Texas

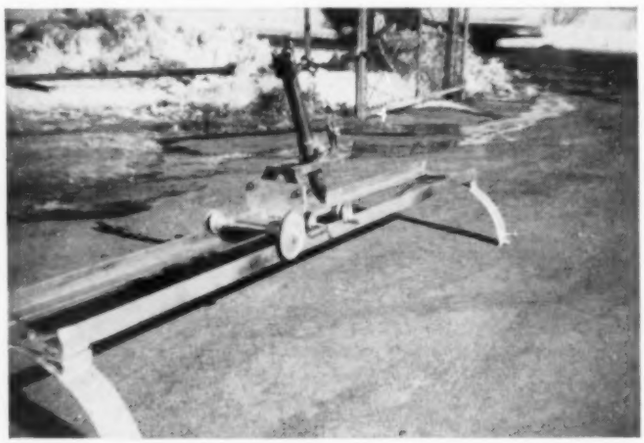


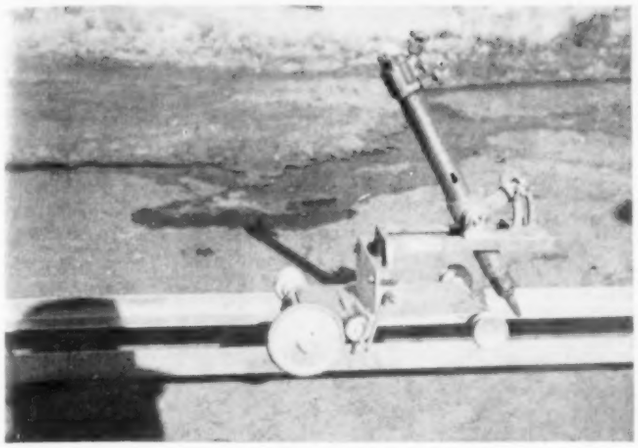
Pipe Splitter Designed to Save Time in Cutting Casing

Installing casing on in-place pipe lines due to the widening of existing roads or construction of new roads is a problem that is increasing because of the Federal highway program. Normally the casing is split and welded around the pipe in "cigarette" fashion rather than taking the line out of service and cutting it. The latter is a haphazard operation inasmuch as it is difficult to make a straight cut along the pipe, resulting in additional time required to weld the seams.

The operation has been simplified by one company by use of a casing splitter where the welder needs no help to cut a joint of pipe, up to 50 feet in length. The machine is simply placed over the pipe, and the cutting torch head is fastened to the dolly portion of the machine, as shown in the pictures. After the torch is moved along by the crank mechanism, a smooth straight cut is made on the pipe. It is then very simple to weld the split pipe sections together for a neat, faster job. The casing splitter, shown in the pictures, is made from 1½-inch angle iron mounted on two semi-circle end sections of metal that are placed on top of the casing to be cut.

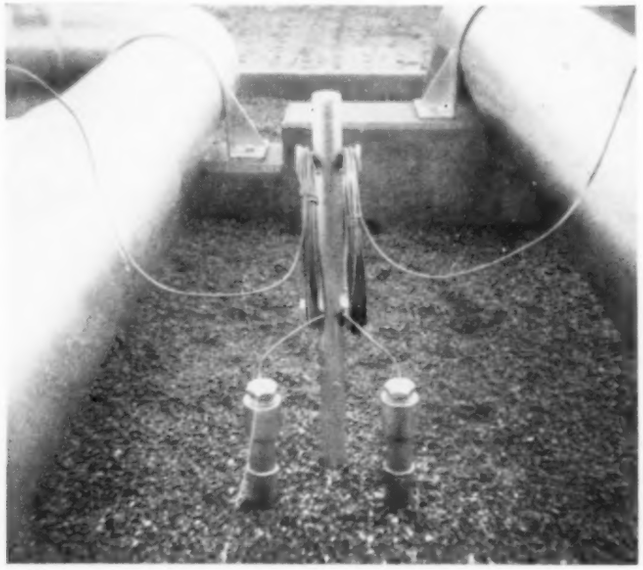
To build the casing splitter as illustrated by the detailed drawing, two sections of 1½-inch angle iron, 72-inches in length, are welded to a 3/16-inch plate, which is welded to two end sections of 16-inch diameter semi-circular metal. For precision adjustment, 3/8-inch hexagonal bolts are placed in three positions on the semi-circular end sections. This portion of the casing splitter





is placed over the pipe to be cut. After the entire unit is placed over the pipe, the cutting torch head is fastened to the crank mechanism, and the machine can be moved along by the welder.

The cutting torch head is fastened to the "dolly," as shown in the pictures, with a butterfly clamp support that can be hand tightened. Adjustment for the desired cutting angle is easily achieved with the angular arm that moves inside the semi-circular slot provided for precision adjustment.



Make Pipe Support For Extra Capillary Tubing

An easily installed method of storing extra capillary tubing can be formed by the use of 2-inch pipe and angle iron clips. This pipe support, which may be set in concrete, should be sealed over on the upper end to eliminate internal corrosion.

The angle iron clips are welded to the pipe approximately 18 inches apart to provide a smooth coil of the tubing such that it will not be crimped. The tubing is tied together with small gage wire. Note that the underground tubing is run in piping which is plastic.

This pipe is easily bent to eliminate sharp corners that may present crimping. The end of the pipe run is equipped with a standard bushing which has been drilled and sawed in half to accommodate the tubing. This opening is then sealed with putty after make-up.

Reduce Maintenance With Proper Bolt Tightening

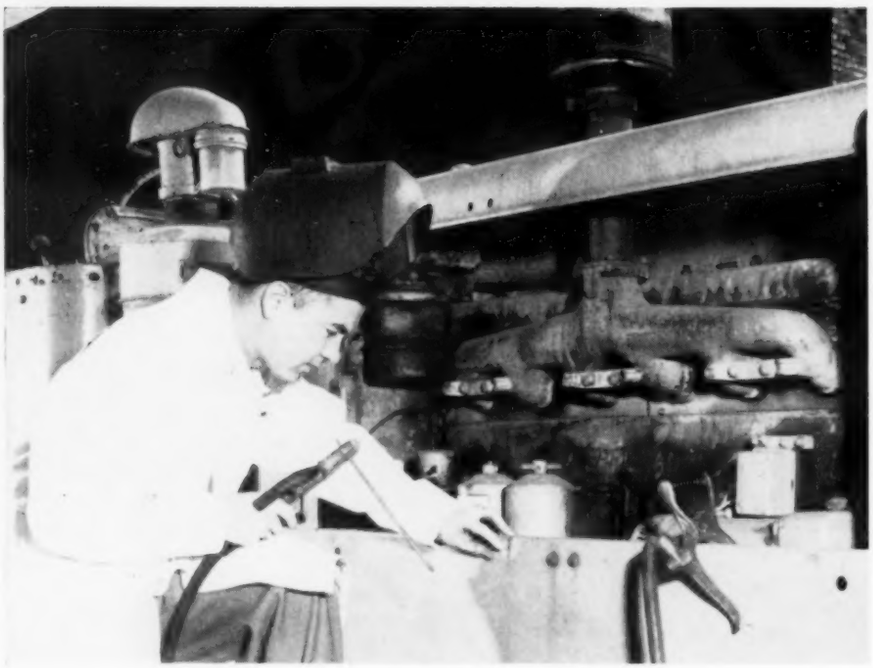
How much should you tighten a bolt, capscrew or nut? Various terms have been applied to tightening such as "finger tight," "snugged," "seated" or "so many pounds-feet tight."

To tighten a bolt the nut must be turned down until the bolt begins to stretch. Stretching is due to the tension from the torque applied to the nut as it is moved up the bolt's thread. Air cleaner wing nuts, for example, are considered "finger tight" when enough torque has been applied by the hand to hold the cleaner tray securely in place. A fitting is "seated" when it is turned into position although not necessarily placed in tension.

Although it is impractical to torque all bolts to close tolerances, according to leading tractor manufacturing companies there are many instances where exact amounts of torque must be applied. Hydraulic pumps and valves, for example, have small internal clearances. While it is desirable to have the parts of these units assembled tightly, too much tightening will reduce internal clearances to zero. Main and connecting rod bearings are round only when the correct torque is applied to the cap nuts. Too much torque will put these bearings out-of-round and cause failure of the parts when the engine is put back into service. Excessive tightening of cylinder head studs can distort the head, creating a possibility for leakage, warping and cracking. A torque wrench should be used to obtain a specific amount of torque when the amount of tightness is critical.

If the torque is not measured, it is easily possible to get an improper gasket crush from too little tightness, or cause distortion or bolt "set" from an excessive amount of torque. Additionally, the recommended tightening sequence should be followed.

This wrench will allow consistently accurate results every time. Torque should be brought up in increments by using a steady pull. Jerking the wrench will result in higher torques than are actually indicated on the wrench dial.



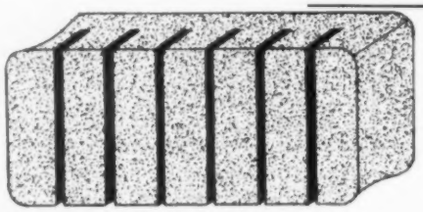
Solid Ground Protects Engine Bearings And Gears From Damage Caused By Arcs

During arc welding a heavy electric current passes from the arc welding generator through cables to the metal being welded. It then jumps across a gap, melts the metal electrode and returns to the generator.

An arc is likely to occur wherever a gap interrupts the flow of current. The heavy welding current may also break up and take numerous paths through a machine on which the welding takes place. Should the current encounter an air gap across a bearing in an engine, it is possible for welding to take place at that spot. Fusion of the two pieces may not take place, but weld blotches on a bearing or gear can cause an early failure of the part, because the ground connection of the arc welder was not properly placed.

A major manufacturing firm states that transmission bearing, engine bearing and gear failures have been traced to arc welds on those parts as arcs have occurred in transmission when welding was performed on front end of a tractor.

To return current to a welding generator it is best to fasten a ground clamp directly to the piece being welded. If this is impractical, clean off rust, oil or paint to give the return current the least chance of going astray. Give return current a short direct path and stray currents will not damage other parts of the machine.



Grooved Piece of Felt Used as Pencil Cleaner

A block of felt such as an old blackboard eraser with a number of parallel grooves in the face has proved to be very efficient for removing graphite dust from pencil points after sharpening. The point is simply run through one of the grooves after sharpening.

Vacuum Hose Provides Towed Truck With Brakes

Towing a truck with a dead engine, makes the vacuum booster brakes inoperative, and the towing truck must do all the braking. With heavy equipment this puts excess load on the towing truck's brakes and can become dangerous.

A vacuum jumper hose can be connected from the supply line of the towing truck to either the supply line or the manifold side of the check valve on the towed truck to supply the latter with a source of vacuum to operate the power brakes.

This method distributes the braking load to more wheels and will reduce the wear on the towing truck. It is also much safer.

Use Sandpaper to Hold Ink Bottle Stationary

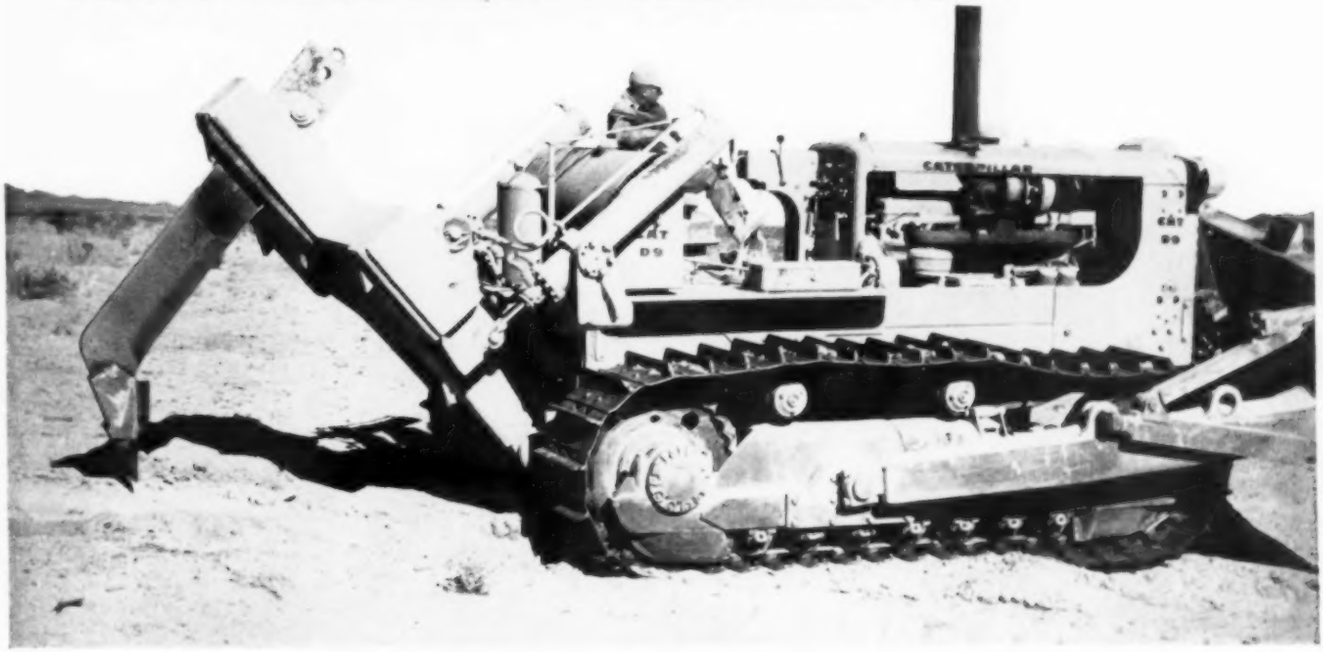
To keep a bottle of ink stationary on a draftsman drawing table, glue a piece of sandpaper to the bottom of the bottle. The rough finish of the sandpaper will keep the bottle from sliding.

Weld Plate to Turnbuckle For Bracing Equipment

Where it is necessary to brace equipment for compression instead of tension, a support can easily be fashioned by welding a plate to one end of a large turnbuckle. The bottom of the turnbuckle is first cut off at the middle of the eye, and a plate large enough to prevent the bottom from sinking into the ground is welded on.

The upper eye of the turnbuckle then can be fastened to the rig and the lower end braced against the ground. This device works well in temporary installations of pumping equipment to prevent vibrations and "walking" of the unit.

RIPS DEEPER
THROUGH FROST AND ROCK



C•R•C KELLEY RIPPER has proven successful in:

- **PIPELINING**
- **HIGHWAYS**
- **STRIP MINING**

• Deep ripping through the hardest of materials, frost and rock, comes easy to the C-R-C Kelley Ripper. This means more production for dozers, ditchers, or scrapers whether you're excavating highways, strip mines, or pipelines.

Maximum ripping depth is seven feet for the largest ripper. For right-of-way clearance two shanks can be used. Hydraulic pistons maintain a constant ripping depth with no danger of the shank raising clear of the ground during a pass.

C-R-C manufactures a full line of rippers to fit almost every tractor. Get full details by calling or writing C-R-C in Houston, Texas.

C-R-C Kelley Coal Ripper shown making a pass through a strip mine. Penetration depth is a maximum 7 feet.

SERVING PIPELINERS SINCE 1933

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P. O. Box 2073 UNderwood 4-6391

FARMINGTON, NEW MEXICO
P. O. Box 1207 DAvis 5-5523

IN CANADA
Canadian Equipment Sales & Service Co., Ltd., 7310 99th St., Edmonton, Alberta, Canada

What's Happening

among MEN in the INDUSTRY

J. R. Fredenberger

C. W. Keith

George F. Russell

Leo J. Brennan

Service Pipe Line Company announces the appointments of a financial vice president and board member, and four new officers selected by the board of directors.

E. F. Udeen

C. W. Keith, former controller of the company, was elected to the board and named a financial vice president. He succeeds **J. L. Shoemaker**, who died recently.

J. R. Fredenberger, former treasurer, was made comptroller to succeed Keith, and **George F. Russell** was elected to the treasurer's post. **Leo J. Brennan** and **E. F. Udeen** are new assistant comptrollers.

Leonard L. Perry, vice president and general manager of **Michigan Gas and Electric Company**, was elected president of the **Michigan Gas Association.**

J. B. Simpson, vice president of **Consumers Power Company**, was named vice president and **Milton G. Kendrick**, **Michigan Consolidated Gas Co.**, was selected secretary. **Arthur Crawley**, Flint division manager of Consumers, was elected to the board.

D. H. Hushion, assistant chief engineer of **Alberta Gas Trunk Line Company Limited**, has been promoted to chief engineer. He succeeds **Eldon V. Hunt**, who was made general superintendent in charge of all operations.

Hushion was associated with **Colorado Interstate Gas Company** for seven years before joining Alberta Gas Trunk Line last year.

W. B. Read has been appointed assistant supervisor to the Oil Movements department of the **Ohio Oil Company. R. W. Palmer** succeeds **R. W. Barnes** as chief crude oil dispatcher.

Read, formerly dispatching engineer, has been with Ohio for nine years. He started as civil engineer in Pipe Line Engineering department and was transferred to the Oil Movements section in 1956. Palmer joined the company in 1939 in the subsidiary Illinois Pipe Line Company. He was moved to the parent company in 1940 and since has been in Oil Dispatching and Accounting departments.

Barnes retired after 46 years with Ohio.

Ralph E. Mullin, president of Westpan Hydrocarbon Company, has been elected to the board of directors of **Colorado Interstate Gas Company.**

Mullin also is president and director of the Lotus Oil Company, Trojan Oil and Gas Company and is vice president and director of A. R. Jones Oil and Operating Company.

Ted Gupton has been appointed management engineer of **Pipe Line Technologists, Inc.** Gupton recently retired as district sales manager, Houston, for Alco Products, Inc. He has been in the pipe line industry since 1920 when he was with the Prairie Pipe Line Company. In 1926 he joined McIntosh & Seymour which became Alco's Diesel division. He was manager of the Diesel division until he was transferred to Houston in 1956.

Dr. Dysart E. Holcomb has been appointed director of research and development for **El Paso Natural Gas Company.** Holcomb resigned as president of Texas Western College to accept the position.

Holcomb will be in charge of all research and development for El Paso Natural Gas and El Paso Natural Gas Products Company as well as their subsidiaries.

Paul Kayser, chairman of the board of **Pacific Northwest Pipeline Corporation**, has been elected president of the company. Kayser succeeds **Stuart F. Silloway**, who resigned to take the presidency of Harriman Ripley & Co., investment bankers.

Kayser had also been chief executive officer of Pacific Northwest.

Laco Pipeline Contractors Inc. has announced the opening of new permanent branch offices in Columbus, Ohio. The new offices will represent Laco in the central and eastern sections of the country. Areas covered by these offices will include Michigan, Minnesota, Ohio, Illinois, Pennsylvania, New York, Maryland, Virginia, West Virginia, North Carolina and South Carolina. **Melvin E. Lee**, company vice president, will maintain offices at the new location.

James W. Rachick

N. D. Holman

N. D. Holman, superintendent of insurance division at **Natural Gas Pipeline Company of America**, has retired and is succeeded by **James W. Rachick**, former assistant superintendent of the division.

Holman has been affiliated with NGPL since 1930 and is past insurance chairman of the Independent Natural Gas Association of America. He will join **Houston Texas Gas & Oil Corporation** as a consultant.

Rachick joined the company in 1950 and became assistant superintendent in 1956. **Werner M. Osdoba** succeeds him.

Donald L. Sedgwick has been elected vice president of Northern Natural Gas Company. Sedgwick, who has been in the industry 40 years, is general manager for Peoples Natural Gas Division of Northern.

D. L. Sedgwick

Before being named general manager of Peoples he was director of marketing for Northern. He has been with Northern since September, 1957.

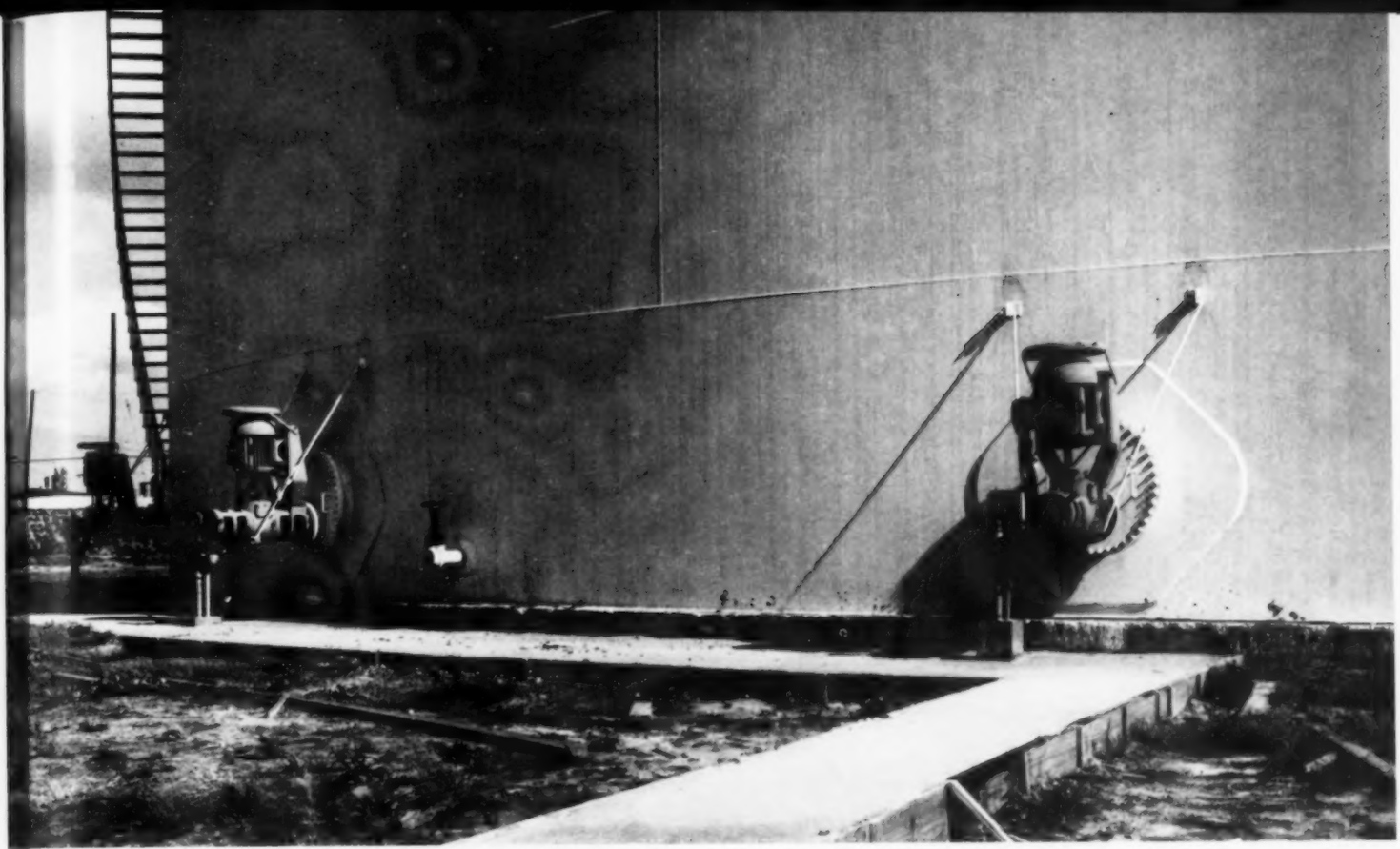
L. B. McCoslin has been appointed assistant chief operator-deliveryman, Concord California for **Southern Pacific Pipe Lines, Inc.**

J. F. Barth

L. Leon Connie

L. Leon Connie has been named director of the Oil Accounting section, and **J. F. Barth** has been appointed supervisor of the Authorizations department of **Service Pipe Line Company.**

Connie succeeds **Ora E. Hunter**, who retired after serving the company for 40 years. Connie has been in the Service Accounting department since 1940 and



You save $1000 per tank per year

when you keep bottoms clean by pressing a button

Take a minute to add up what it costs you to clean out the sediment in an 80,000-barrel crude storage tank.

The answer—5000 to 8000 dollars—may amaze you. Yet these figures are based on careful field studies by a major pipeline company.

Your total cost includes:

- what you pay for cleaning
- your overhead while the tank is out of service
- value of refinable oil and wax you lose in the bottoms (at least $2000—and sometimes as high as $6000).

Fortunately, this is one expense you don't have to accept. Prevention is easy. Put LIGHTNIN Mixers on your tanks, and start enjoying savings *on the order of $1000 per 80,000-barrel tank per year.* Savings on larger tanks are equally spectacular.

No need to scrape out sludge

You eliminate sludge buildup—for good—when you install LIGHTNIN Mixers. By pressing a switch button, you start the tank contents in gentle motion that keeps sediment suspended in the crude, or resuspends any that has settled. You can keep bottom sediment level, year to year, as low as *one inch.*

You dispatch a more uniform crude when you use LIGHTNINs in your tanks. Crude leaving the tank has the same values as when it entered the tank. You overcome the risk of large slugs of accumulated sediment breaking loose and moving into the pipeline.

By eliminating downtime for sludge cleanout, you keep your tank farm's *full holding capacity* ready for use when you need it. You gain as much as 12% more storage capacity—without adding a single tank.

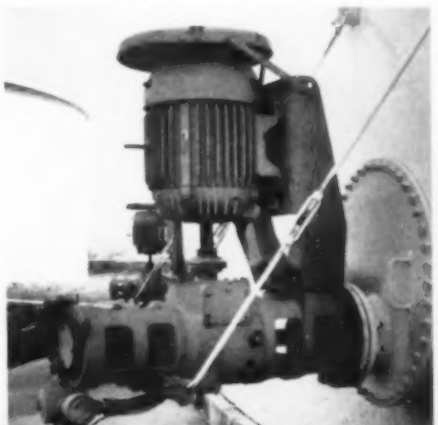
Do this today

More than 50 independent pipeline companies and about 35 leading producers and refiners are cutting crude storage costs this effortless LIGHTNIN way. So can you! To see how, just call in your LIGHTNIN Mixer representative (listed in Pipeline Composite Catalog). Or write us direct.

Lightnin® Mixers

MIXCO fluid mixing specialists

LOW OPERATING COST. It takes as little as one hour to suspend sediment in a full tank. Upkeep is simple; choice of stuffing boxes to meet your conditions, or mechanical seals that eliminate stuffing-box maintenance.



Get these helpful bulletins on BS&W control and LIGHTNIN Mixers. Check, tear out and mail to us today with your name and company address. Free—no obligation.

- ☐ BS&W Control with LIGHTNIN Mixers (B-503)
- ☐ Side entering mixers, 1 to 25 HP (B-104)
- ☐ Data sheet for figuring mixer requirements (B-107)
- ☐ Condensed catalog describing LIGHTNIN Mixers—all types (B-109)
- ☐ LIGHTNIN rotary mechanical seals for extra-low-cost mixing (B-111)

MIXING EQUIPMENT Co., Inc., 196-j Mt. Read Blvd., Rochester 11, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Avenue, Toronto 10, Ont.

SOONER BOOMERS "team up" for laying large diameter lines!

Construction crew at Laclede Gas Company, St. Louis, is shown lowering in a section of coated and wrapped steel main in the Kirkwood area of St. Louis. Note two Sooner Boomer units are being used, assisted by a crane. For over 2 years, Laclede Gas has made good use of their Sooner Boomer units, keeping them busy throughout the year.

Rubber-tire mounted SOONER BOOMER does work of 2 conventional machines!

The only proven side boom on rubber tires, the Sooner Boomer —designed to handle 10" pipe— eliminates unnecessary right-of-way damage on city work as shown above. It also eliminates the need of pipe stringing along city streets ahead of ditch. A low center of gravity makes the Sooner Boomer highly stable, loaded or unloaded. Highly maneuverable, it operates at road speeds up to 27 MPH. The 12-ft. boom makes it possible to lower in over spoil. Other features include all-hydraulic operation; hydraulic controlled counter weights; power steering; perfect operator visibility; lowest initial cost and lowest operating cost! Call, wire or write for complete details now!

SOONER BOOMER
MFG. DIV.
Oklahoma City Oklahoma

PHONE TR 8-2127

P.O. BOX 8686

was promoted to a group leader in 1951. Barth joined Service in 1933 and was named a senior clerk in the authorizations department in 1942. He was made assistant supervisor in 1955 and succeeds **J. C. Stirling** in his new position.

Harold C. Price, Jr., has been appointed to the position of vice president in charge of the **H. C. Price Construction Company,** Pipe Line division. Price will succeed **John M. Thomas,** who is retiring as vice president, but will remain a pipe line consultant and member of the board.

Harold C. Price, Jr.

Price assumes full responsibility for activities of Pipe Line division of the company. He has been with the company since 1950 and was named a vice president in 1955. For the past two years he served as vice president in charge of Canadian construction activities.

Aristotle A. Copetas has been named manager of system gas supply for **Consolidated Natural Gas Company.** He succeeds **J. J. Schmidt** who was elected president of **Hope Natural Gas Company.** Copetas will make his headquarters in Pittsburgh where two subsidiaries, New York Natural Gas and Peoples Natural Gas are located.

Aristotle A. Copetas

Copetas joined Peoples in 1939 and was transferred to Hope Natural Gas in 1940. He moved to Consolidated Natural Gas in 1947 and was appointed chief statistician in 1954. He was named assistant manager of gas supply in 1957.

Continental Pipe Line Company announces the appointment of **Max E. Stansbury** as the director of industrial relations for the company. Stansbury, who has been with Conoco since 1936, has served as assistant manager of the company's Industrial Relations department.

Stansbury joined Conoco's Los Angeles production office in 1946; was made administrative assistant in industrial relations at Ponca City then was transferred to Houston. In 1953 he became manager industrial relations for southern and southwestern regions and was promoted to assistant manager of the department in 1954.

Stephen H. Baer has been selected to fill the newly created post of public relations director for the **Pacific Lighting Gas Supply Company.**

Baer will be in charge of developing programs to meet the company's widening public relations challenges, including those resulting from major construction projects and the taking of out of state gas. Baer will also edit the company's internal publications. He has been head of the News-Publications Bureau of Southern Counties Gas Co. since 1955.

Texas Gas Transmission Corporation has appointed **Glover H. Cary, Jr.**, manager of industrial development. He will supervise and coordinate a staff of industrial representatives whose mission is to advise and inform site-seeking industries of advantages of locations in areas near the company's service.

Glover H. Cary, Jr.

Cary has been with the company since 1950 and has served in the Pipe Line, Public and Employe Relations and Company Housing departments.

Lee A. Christensen has been named general manager, Traffic department, for **Sun Oil Company.** Christensen succeeds **Thomas G. Rabbitt** who is on special assignment with Sun.

Christensen has been with Sun since 1949 and has been assistant general manager since 1952. Prior to his association with Sun, he had served in the transportation field with the Association of American Railroads; Elgin, Joliet, and Eastern Railroads; Lehigh Valley Railroad and Mid-Valley Pipeline Company.

Trans-Arabian Pipe Line Company announces three appointments in its Operating Services department. **D. T. Pinckney** was named manager of operations; **C. H. Pope** was made manager of operating services; and **A. E. Olson** became chief engineer.

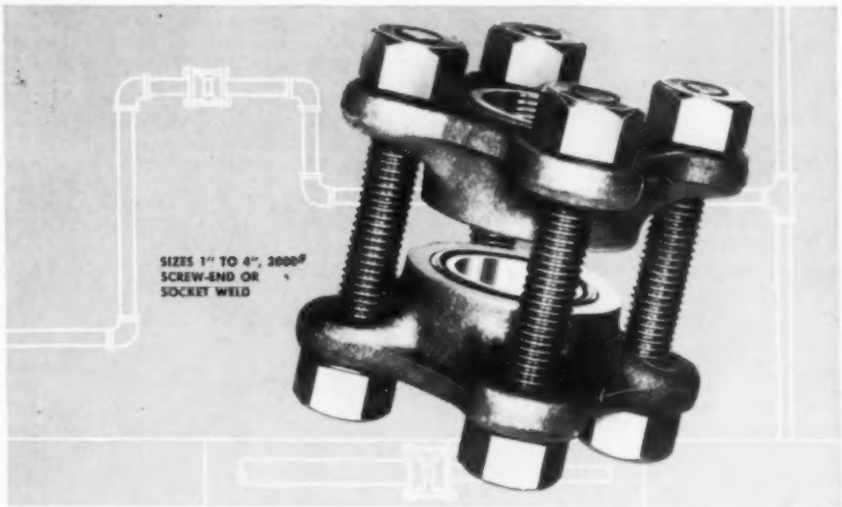
Pinckney has been with Tapline since 1947 and had been assistant manager of operations. Pope also joined the company in 1947 and in 1956 was appointed assistant to the executive vice president. Olson, who has been associated with Tapline for 12 years, had been chief field engineer and manager of construction of the capacity increase program.

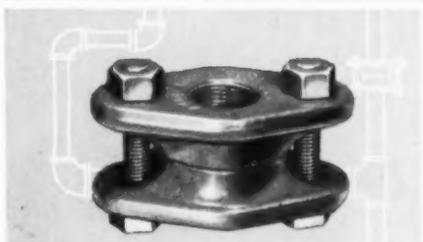
The **Canadian Gas Association** has announced the appointment of **Douglas E. Dingwall** as advertising manager. Dingwall will be directly concerned with coordination of the association's PAM national advertising program which is aimed at promoting the sale of natural gas and gas appliances and equipment.

Theodore E. Swigart, retired president of **Shell Pipe Line Corporation,** has been elected a director of the Texas Fund, Inc. Swigart resigned as a director of the Texas Fund Management Co. He replaces **James E. Anderson,** who died recently.

John B. Carter, Jr. a Houston financial consultant and independent oil operator, was elected to succeed Swigart as a director of the Texas Fund Management Co. Swigart presently is petroleum advisor for Morgan Stanley & Co. and chairman of the board of North Central Oil Corporation. Carter is a former secretary and treasurer of Texas Fund, Inc.

W-S The double diamond assures double value




SIZES ¼" TO 1", 3000# SCREW-END OR SOCKET WELD

SIZES ½" TO 3", 6000# SCREW-END OR SOCKET WELD

Installation flexibility with permanent piping strength

GET BOTH WITH W-S O-RING FLANGE UNIONS

NOW, you can install high pressure piping systems that can easily be rearranged and adapted with full assurance that the unions will give the leak-proof service of permanent installations. This is made possible by these adaptable features of W-S O-Ring Flange Unions:

- Available in 2-bolt and 4-bolt types, according to size.
- Sizes ¼" to 1" in 2-bolt 3000#; sizes 1" to 4" in 4-bolt type 3000#; sizes ½" to 3" in 4-bolt type only 6000#.
- Available in Screw-end and Socket Welding Types—3000# and 6000#.
- O-Rings available in a variety of materials for a wide range of service.

Specify forged steel W-S O-Ring Flange Unions for a tight seal against fluid pressure in piping for hydraulic machinery, refrigeration piping, steam and water lines, process liquid and gas lines, and many other applications.

For full specifications, write for Bulletin U-1-58

W-S manufactures a full range of high quality drop forged fittings, unions and couplets . . . in carbon, stainless and alloy steels. For full information about these products, or for your specification forging requirements, write to: W-S Fittings Works, H. K. Porter Company, Inc., Box 95, Roselle, N. J.

H. K. PORTER COMPANY, INC.

FORGE AND FITTINGS DIVISION

W-S Fittings Works, Roselle, N. J. • Cleveland Forge Works, Cleveland 4, Ohio
Stainless Steel Works, Duncannon, Pa.

For more data on advertised products, use Readers' Service Cards, last page.

WHO'S MEETING WHERE

September

Pacific Coast Gas Association, Multnomah Hotel, Portland, Oregon, Sept. 2-4.

New Jersey Gas Association, Spring Lake, New Jersey, Sept. 5.

National Petroleum Association, 56th annual meeting, Traymore Hotel, Atlantic City, N. J., Sept. 10-12.

Instrument Society of America, 13th Annual Instrument Automation Conference and Exhibit, Philadelphia, Sept. 14-19.

Independent Natural Gas Association of America, annual membership meeting, Roosevelt Hotel, New Orleans, Sept. 15-16.

American Institute of Electrical Engineers, conference of petroleum industry, Baker Hotel, Dallas, Sept. 15-17.

Southeastern Gas Association, Sir Walter Hotel, Raleigh, N. C., Sept. 17-19.

Natural Gasoline Association of America, Rocky Mountain Regional meeting, Gladstone Hotel, Casper, Wyo., Sept. 18.

ASME, Petroleum division, mechanical engineering conference, Cosmopolitan Hotel, Denver, Sept. 21-24.

Seventh International Gas Conference, Rome, Italy, Sept. 22-25.

ASME, power conference, Hotel Statler, Boston, Sept. 28-Oct. 1.

October

NACE, Northeast Regional Conference, Hotel Somerset, Boston, Oct. 5-8.

California Natural Gasoline Association, 23rd annual fall meeting, Huntington-Sheraton Hotel, Pasadena, Calif., Oct. 9-10.

OIL PROGRESS WEEK, Oct. 12-18.

American Gas Association, annual convention, Atlantic City, N. J., Oct. 13-15.

National Electronics Conference, Hotel Sherman, Chicago, Oct. 13-15.

ASME, American Society of Lubricating Engineers, conference on lubrication, Statler Hotel, Los Angeles, Oct. 13-15.

ASCE, Civil Engineering Show, annual convention, Hotel Statler, New York, Oct. 13-17.

NACE, North Central Region, Cincinnati, Oct. 15-17.

Society of Petroleum Engineers of AIME, Southern California petroleum section, Biltmore Hotel, Los Angeles, Oct. 16-17.

Permian Basin Oil Show, Odessa, Texas, Oct. 16-19.

NACE, South Central Regional Conference, Roosevelt Hotel, New Orleans, Oct. 20-24.

Society of Automotive Engineers, national diesel engine meeting, Lord Baltimore Hotel, Baltimore, Oct. 22-24.

Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas, Oct. 27-28.

American Institute of Electrical Engineers, general meeting, Pittsburgh, Oct. 26-31.

November

Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa, Nov. 5-6.

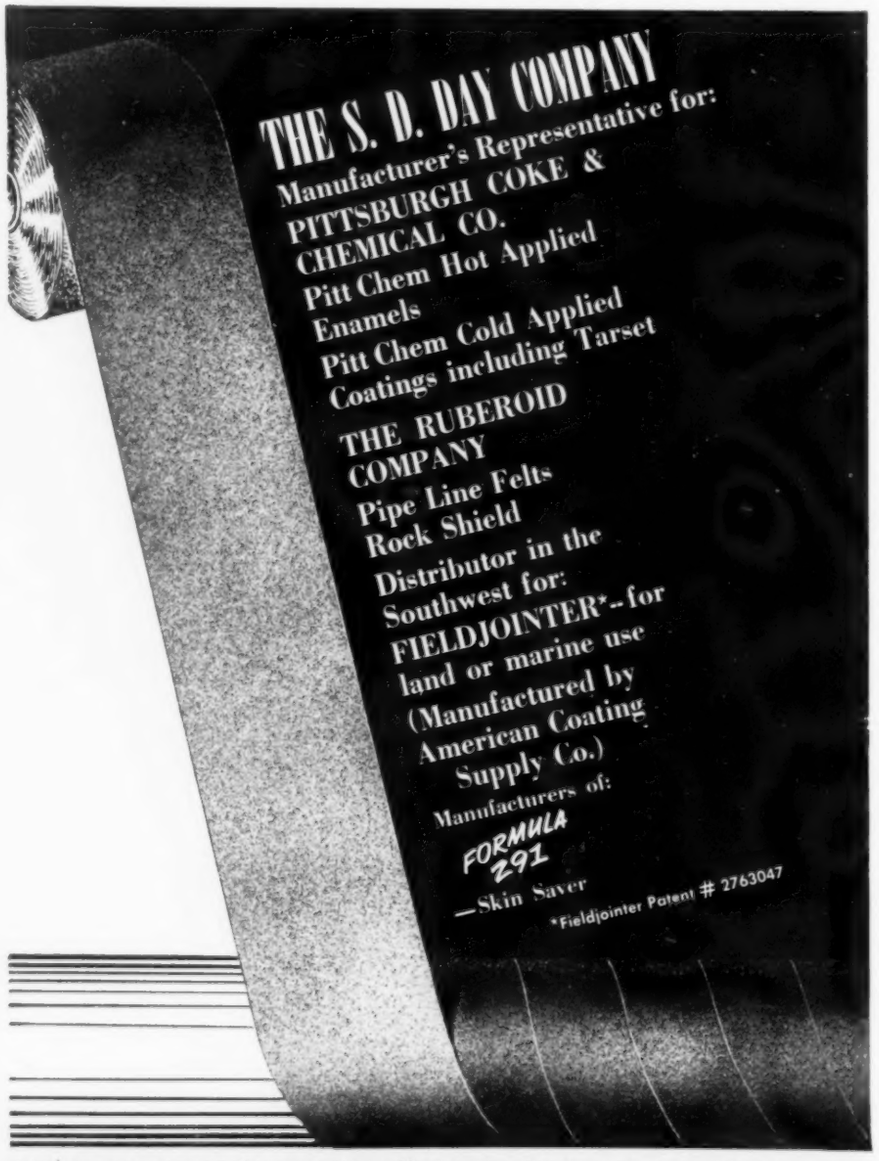
Transportation Club, Petroleum Industry, annual meeting, Bismarck Hotel, Chicago, Nov. 10.

API 38th Annual Meeting, Conrad Hilton Hotel, Palmer House and Congress Hotel, Chicago, Nov. 10-13.

NACE, Western Region, fall meeting, Statler Hotel, Los Angeles, Nov. 17-19.

Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Texas, Nov. 21.

ASME, annual meeting, Statler and Sheraton-McAlpine Hotels, New York, Nov. 30-Dec. 5.



What's Happening among SERVICE and SUPPLY MEN

Officers of Coating Society of Houston Area

The Coating Society of Houston area will conduct a two-session coating school on the applicatory level September 6 and 7 at Hanna Construction Company, Houston. Purpose of the school is to coordinate knowledge of proper coating techniques between applicators, suppliers, users and management. Officers pictured above are, left to right, H. M. Edwards, Petro-Tex Chemical Company, treasurer; F. Parker Helms, Carbide & Carbon Company, vice president; R. H. Bacon, Dow Chemical Company, president; M. W. Belue, Champion Paper & Fibre Company, secretary; and O. A. Melvin, Carboline Company, chairman of education committee.

Three Region Managers Named By Allis-Chalmers Mfg. Co.

Richard L. Engel has been appointed manager of Industries Group Pacific region; N. W. Landis is the new manager of the Northeast region; and Clinton F. Kucera has been named manager of the New York district office of Allis-Chalmers Manufacturing Company.

Alexander Dreisin has been appointed chief engineer of the Fuel Injection department at Harvey, Ill. Engel has been with Allis-Chalmers since 1939, and previously was the Group's Los Angeles district manager. Landis, Industries Group New York district manager since 1955, is a 20-year veteran with Allis-Chalmers. Kucera has been assistant manager of the New York district office since 1957.

Berry Hydraulics Transfers H. S. Cain and R. O. Mlady

Berry Hydraulics announces the addition of H. S. Cain and R. O. Mlady to its general office sales engineering staff in Pittsburgh.

Cain moves to his new position from Houston, where he specialized in hydraulic pumps and motor applications in gas transmission plants.

Mlady has been an application engineer at Berry's plant in Corinth, Miss.

Dwight R. Craig Chosen Vice Chairman of ASME

Dwight R. Craig of Cooper-Bessemer has been elected vice chairman of the Columbus, Ohio, section of the ASME. Craig is the assistant chief engineer, Prod-

Tri-State Oil Show

ROBERTS MUNICIPAL STADIUM — OCTOBER 9, 10, 11 and 12, 1958

EVANSVILLE, INDIANA

"The Oil Capitol of the Midwest"

Sixth Annual Tri-State Oil Show:

EXHIBITORS:

Exhibit Space Inside Stadium.
Open Spaces on Paved & Unpaved Surfaces Outside Stadium.
Tented Spaces, Outside Stadium.
Open House—Thursday Evening, Oct. 9, 1958 for Exhibitors and their guests only (Admittance by invitation only—closed to public. Dinner, social hour and entertainment.

CONVOY TO PERMIAN BASIN OIL SHOW—ODESSA, TEXAS, from TRI-STATE OIL SHOW Leaving at daylight, Monday morning, October 13, 1958. Plenty of time to reach Odessa to set up exhibits.

ENTERTAINMENT: Top Television Entertainers for all ages.

ADDRESS INQUIRIES TO *Tri-State Oil Show*

15 Main Street, Evansville, Indiana **Phone HArrison 5-3176**

ucts division, of Cooper-Bessemer. Craig also has been a member of the executive committee, Columbus section, of the ASME.

Black, Sivalls & Bryson Moves Sales Headquarters

Black, Sivalls & Bryson, Inc., has moved its sales headquarters for the West Texas-Rocky Mountain area from Oklahoma City to Dallas.

Also, district offices for the North Texas area have been moved from Fort Worth to Dallas. Harold O. Ebeling has been named manager of the Dallas Oil Field district. Ebeling joined the company in 1952 and served as manager of sales engineering for the past two years.

Charles Kuhn

Charles G. Thomas

Charles Kuhn Named Sales Manager By Dresser Manufacturing Division

Charles Kuhn has been appointed sales manager, regular products, by Dresser Manufacturing Division. Charles G. Thomas has been promoted as acting manager of purchases.

Kuhn had been vice president in charge of sales for Hills-McCanna, Chicago. Prior to his association with Hills-McCanna, he had been with Fansteel Metallurgical Corporation. Kuhn assumes the position vacated by H. Z. Hight, now president of Bonded Products, Inc.

Thomas has been with Dresser since 1942 and had been chief engineer and assistant works manager.

Tube Turns Appoints Tolliver Eastern Region Sales Manager

Jack D. Tolliver has been named to the newly created post of manager of the Eastern region for Tube Turns, division of Chemetron Corporation. He will be succeeded as manager of the Sales Development department by Edward F. Harrington.

Jack D. Tolliver

Tolliver will have responsibility for eastern sales operations covered from offices in New York, Philadelphia, Pittsburgh, Chicago, Louisville and Atlanta.

He had been a sales engineer with the Worthington Corporation and International Supply Company before joining Tube Turns in 1954. At Tube Turns he has been in the Product Engineering and Research department and later the Sales Development department.

Midwest Piping Company Elects Blum Executive Vice President

Fred J. Blum has been elected executive vice president and secretary of Midwest Piping Company.

Blum has served the company for 38 years and was formerly vice president and secretary.

Allis-Chalmers Appoints Two District Managers

Ralph L. Haney has been named Philadelphia district manager, and Charles E. Dandois is the manager of Allentown, Penn., district for Allis-Chalmers Manufacturing Company.

Haney succeeds C. W. Parker, Jr., who was promoted to director of sales promotion. He had been manager at Allentown since 1956 and previously he had been sales representative in the Boston district for 10 years.

Dandois formerly was sales representative in Allentown district and has been associated with the company since 1949.

ALCO Products, Inc. Names Three Division Managers

ALCO Products, Inc. has established sales managers for the company's three major products divisions in a realignment of its field marketing organization.

Paul W. Geisler has been assigned manager for Thermal and Petroleum Industry Equipment divisions; Robert W. Pittman was appointed manager for transportation products and services; and Robert H. Binkerd was named manager, industrial equipment, Spring and Forge division.

Geisler has been with the company since

For precise pneumatic control operation . . .

Come to Kemp

Put an end to pneumatic control stoppages due to freezing, corrosion, and vapor locks. Install famous Kemp Oriad Dryers on your air lines to remove moisture and dirt. . .keep controls and delicate instruments operating smoothly and accurately.

Kemp Oriad Dryers on your lines cost surprisingly little. . . upkeep and maintenance costs are negligible. Rugged Kemp design keeps dryers operating perfectly, year after year.

Call your Kemp Representative or write us direct for Bulletins D-102 and D-103. The C. M. Kemp Mfg. Co., 405 E. Oliver St., Baltimore 2, Md.

KEMP OF BALTIMORE

Available in all sizes for automatic, semi-automatic, or manual operation. Steam or electric reactivation.

1931 and previously was eastern regional manager. Pittman, who has been with ALCO since 1947, formerly was regional manager at Cleveland. Binkerd has been with ALCO 15 years and prior to his promotion had been sales promotion manager, Spring and Forge products.

G. E. Best

C. H. Kellogg

L. W. Todd

M. A. Park

Jones & Laughlin Names Four District Sales Managers

Jones & Laughlin Supply Division announces the appointments of four district sales managers. G. E. Best, formerly sales manager of Central Rocky Mountain district, is the new sales manager for the North Louisiana-Arkansas district at Shreveport, La., M. A. Park formerly at North Rocky Mountain district, has been assigned sales manager for the Central Rocky Mountain District at Casper, Wyo. C. H. Kellogg has been promoted to sales manager for the North Rocky Mountain district at Williston and L. W. Todd, has been elevated to sales manager for the Mississippi district at Laurel.

Best has been with Jones & Laughlin since 1947. In 1954 he was made assistant district sales manager for the South Rocky Mountain district. Park has been associated with the company for 25 years and became sales manager of Rocky Mountain district in 1944. Kellogg, a former salesman at Williston, has been with Jones & Laughlin since 1946. Todd joined the company in 1955 and was promoted to salesman at Morgan City, La., in 1956.

Robert P. Thomsen Appointed Sales Manager of Dollinger Corp.

Robert P. Thomsen has been appointed sales manager of the Dollinger Corporation. Thomsen, who previously had been advertising manager, succeeds Lewis L. Dollinger, Jr., who recently was named president of the company.

He has been with Dollinger since 1952 after having been with Warren Institute for Savings.

Vernon S. Walker Appointed Sales Representative for Kerotest

Vernon S. Walker has been named steel sales representative for Kerotest Manufacturing Company. Walker had been sales engineer before his promotion.

Territories assigned to Walker include states of Oklahoma and Kansas, and a portion of Missouri with offices in Tulsa.

Midwest Piping Company, Inc. Reopens Atlanta, Tulsa Offices

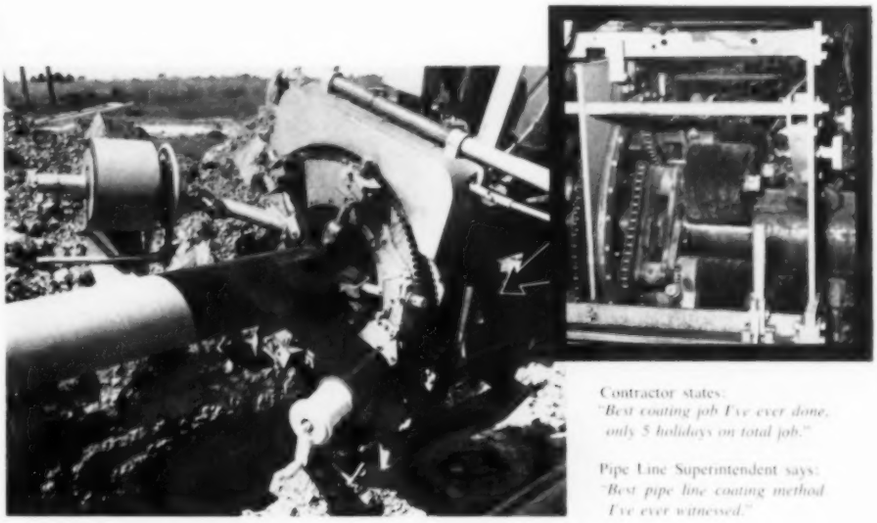
Midwest Piping Company, Inc., announces the reopening of offices in Atlanta and Tulsa. The Atlanta office will be under the direction of John Castleman and the Tulsa office is headed by Claude L. Doughman.

Midwest also announces the appointments of C. B. Moore and Cecil Hilliard as sales representatives. Moore formerly was with Jones & Laughlin Supply Division, and Hilliard had been with Republic Supply Company. Both are to be located in Houston.

De Laval Announces Several Sales Organization Appointments

De Laval Steam Turbine Company announces several changes in the company's sales organization staff. C. E. Cromwell has been named manager of commercial sales. Cromwell, who has been with the company for 21 years, also will continue as field sales manager. A. L. Foltz, manager of the Detroit district office since 1953, becomes manager of the Chicago district. J. F. Donovan, a sales engineer for the past nine years, has been ap-

C. E. Cromwell



Contractor states: *"Best coating job I've ever done, only 5 holidays on total job."*

Pipe Line Superintendent says: *"Best pipe line coating method I've ever witnessed."*

POLYKEN *Performs . . .*

On Multiple Line Laying

An outstanding example on a multiple line laying job . . . consisting of two 6-inch and one 3-inch lines in *one* ditch . . . was recently completed in the Gulf Coast area. This entire multiple line laying operation was accomplished in gumbo soil.

POLYKEN . . . proven polyethylene tape was used on the entire project. The outerwrap that was used in this operation was Cathodic Protection Service's Dulux No. 2.

A single taping machine . . . a Betzel Tapemaster, a power driven, cleaning and taping machine . . . simultaneously cleaned, taped and outerwrapped all pipe, of both dimensions, before the lines were laid in the ditch. For further information regarding detailed applications, please call or write the CPS office nearest you.

CPS **cathodic protection service**

P. O. Box 6387 Houston 6, Texas JAckson 2-5171

CORPUS CHRISTI 1620 South Brownlee TUlip 3-7264
DENVER (Golden) P.O. Box 291 CRestview 9-2215
NEW ORLEANS 1627 Felicity JAckson 2-7316
ODESSA 5425 Andrews Hwy. EMerson 6-6731
TULSA 4142 S. Peoria Riverside 2-7393

Cable Address — CATPROSERV

pointed manager of the Detroit district, and W. H. Mouquin has been named New York district manager.

Expansion Program Planned By F. H. Maloney Company

F. H. Maloney Company of Houston will erect two new buildings in an over-all expansion program this year to increase its production. Three 1,200 ton molding presses and other new equipment will be added to existing and proposed facilities.

Production facilities will be increased 50 percent, from 90,000 square feet to 130,000, and an additional building will be constructed later.

D. W. Onan & Sons Inc. Names New General Sales Manager

Roy E. Mullin has been named general sales manager of D. W. Onan & Sons, Inc. He will replace Hiram Hascall who will retire at the end of the year.

Before joining D. W. Onan & Sons, Mullin had been vice president in charge of sales and marketing for a large automotive manufacturing company.

Philadelphia Gear Corp. Elects S. L. Crawshaw Vice President

Philadelphia Gear Corporation announces the election of S. L. Crawshaw as vice president of the company. Crawshaw, who has been with the company since 1955, will direct high precision gear grinding activities. He is a past president of the American Gear Manufacturing Association.

Kenneth Defenbaugh

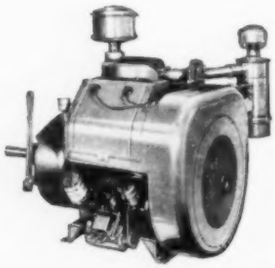
W. C. Cherry

Jack Scott

C. E. Hatcher

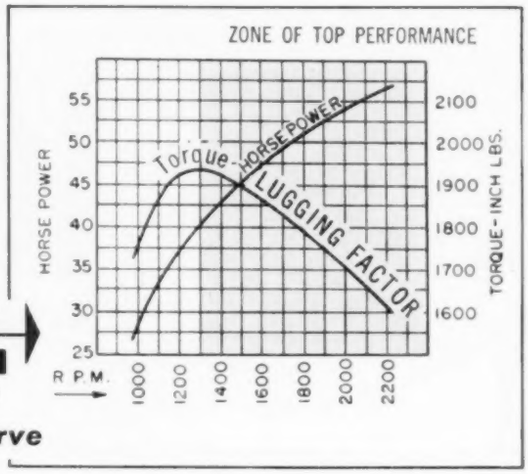
Judge your power unit by its

LUGGING FACTOR!



Model VR4D 56 hp

WISCONSIN heavy duty Air-Cooled ENGINE power curve



When the power load suddenly *builds up* and the engine speed *slows down* . . . how long will the engine *hang on* and carry the increased load without stalling?

The answer lies in the HIGH TORQUE LUGGING FACTOR which is an integral part of "Wisconsin" basic engineering. The point at which an engine will stall under suddenly increased loads is the *High Point* in the TORQUE CURVE. As a case in point, analyze the Wisconsin Model VR4D power curves reproduced here.

This engine develops its maximum horsepower (56 hp.) at 2200 rpm. at which point it registers a torque of 1600 inch-lbs. The engine runs into heavy going. The load builds up fast. The rpm. slows down to 2000, 1800, 1600 and 1400 rpm., reaching its maximum torque *at the low speed* of 1300 rpm.

In terms of power service to the user, this simply means that your Wisconsin Engine is designed *to provide dependable load-holding power at low engine speeds*. This, in turn, means fewer shutdowns, less wear and tear, more usable power and more versatile performance for your dollar investment.

These are reasons why it pays to specify "Wisconsin Power" for your equipment. For a briefing on the full line, write for Engine Bulletin S-223.

WISCONSIN MOTOR Corporation
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
619 SOUTH MAIN STREET • TULSA, OKLAHOMA
3420 McKINNEY AVENUE • HOUSTON, TEXAS
505 SOUTH MAIN STREET • WICHITA, KANSAS
OIL FIELD DISTRIBUTORS FOR WISCONSIN ENGINES AND ALL TYPES OF UTILITY UNITS

A8-6218

Crutcher-Rolfs-Cummings Appoints Four New Officers

Crutcher-Rolfs-Cummings announces the appointment of three vice presidents and a secretary-treasurer. The new officers will take charge of active management of the company.

Kenneth Defenbaugh, previously a partner in an Oklahoma City firm, has assumed office as vice president and general manager. C. E. Hatcher, formerly in charge of the company's Internal Pipe Coating division, has been made a vice president. Jack Scott, who had been sales and service manager, is vice president in charge of sales and services. W. C. Cherry, chief accountant and comptroller, was promoted to secretary-treasurer.

A. O. Smith Corporation Names Three Sales Managers

A. O. Smith Corporation announces the appointments of three sales organizational changes in sales manager positions.

J. W. Harris was promoted from area manager, Houston, to sales manager, Engineering Products, on a national level. W. T. Schultze becomes area sales manager, Northwest territory with headquarters in New York, and W. D. Burns is the new sales manager Plains territory with offices in Tulsa.

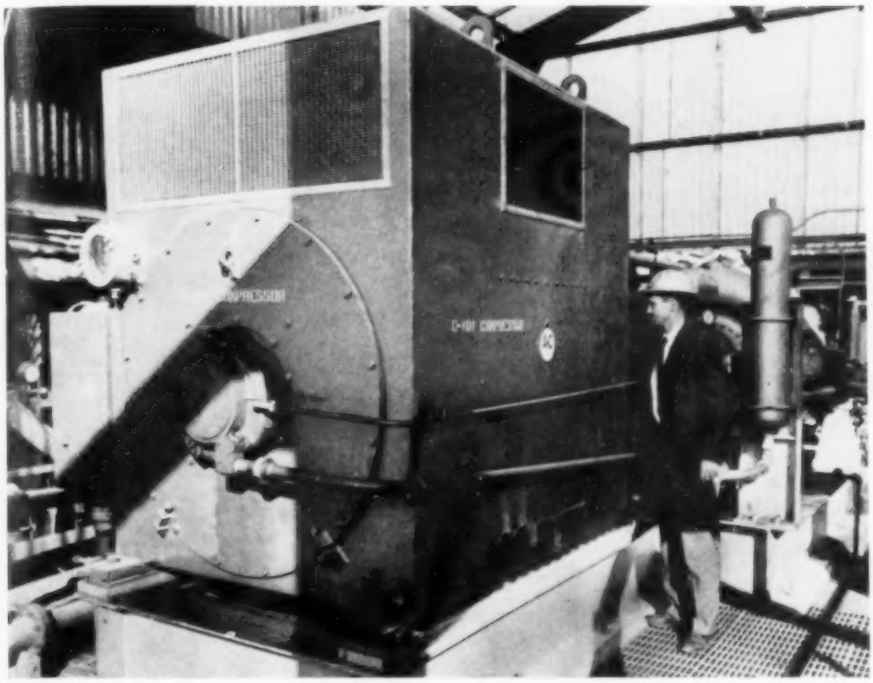
Southwest territory, with headquarters in Houston, has been split into two territories: Gulf with headquarters in Houston and Plains, with headquarters in Tulsa.

Ladish Company Opens Texas Division in Houston

Ladish Co. of Cudahy, Wis., announces the opening of a new manufacturing plant, sales service office and warehousing facilities which will operate as the Ladish Co. Texas Division.

The Houston office will serve needs of industries in Texas, Gulf Coast area, Mid-Continent and Southwest with service in pipe fittings, corrosion resistant valves, saw blades, drop forging and rolled rings.

What's New in EQUIPMENT



Super Seal Motor

Allis-Chalmers super seal motor is now being successfully applied to outdoor installations in the pipe line and petroleum industries. The homogenous vulcanized coil structure of this motor makes it possible for operators to eliminate ambient condition problems, and total enclosures or ventilating schemes.

The motor has recently been used in pipe line pumping stations. A 2,500 hp, 4160 volt, 1,785 rpm squirrel cage super seal motor was installed for pumping service in remotely controlled outdoor stations at Roachdale, Ind., and Martinsville, Ill.

One of the features of the motor is it's accessibility for cleaning; "silcoflex" windings need no revarnishing; if damaged area is readily accessible, repair can be made without removing "silcoflex" from the winding.

(This item supplements Allis-Chalmers data on Pages 41-44 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E1** on Readers' Service Card, last page this issue.

Outerwrap Pipe Protection

The Philip Carey Mfg. Company announces a Carey-Glass outerwrap designed for the protection of pipe coating from mechanical damage during handling and lowering-in operations.

High tensile strength for high speed application and low initial installation costs are two outstanding characteristics of this product. The surface of the material is coated with a flake mica that reflects heat to provide faster cooling and hardening of enamel coating.

The wrap can be used with either coal tar or asphalt enamel and serves as a protective shield where tape coatings are applied.

(This item supplements The Philip Carey Mfg. Company data on Page 72 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E2** on Readers' Service Card, last page this issue.

Impact Wrench

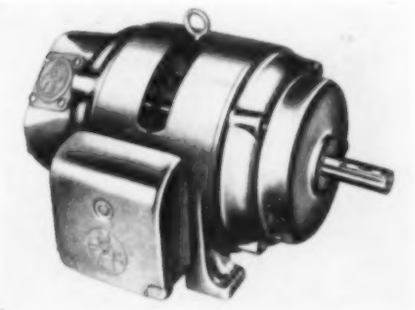
Gardner-Denver Company has developed a new impact wrench which has proved to have the ruggedness and reserve capacity for extended periods of operations.

The wrench, which greatly reduces maintenance problems common to impacting mechanism, is available in two models. Both feature light weight and small dimensions and are rated at ¾-inch nut-setting capacity.

Model 18B-7 is equipped with ¾-inch square drive and 18B-7s has ⅜-inch built in hexagon slip chuck. Stude drivers, socket adapters, hexagon shank sockets holders and universal joint socket adapters are available as accessories.

(This item supplements Gardner-Denver data on Pages 145-152 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E3** on Readers' Service Card, last page this issue.



Capacitor Start Motors

Designed to provide high starting torque and operating efficiency, a line of heavy duty capacitor start induction run motors is announced by Fairbanks, Morse & Company.

For starting, the single phase, integral horsepower motors use capacitors of dry electrolytic type designed for maximum starting torque with minimum current usage. When motor gains speed, a centrifugal switch cuts out capacitors for straight induction run. Motors are equipped with drip-proof corrosion-resistant cast iron frames. A copperspun rotor is also used in the new capacitor motor.

For more data, circle **No. E4** on Readers' Service Card, last page this issue.

Pipe Patch Tools

Constructed for the purpose of repairing pipe lines while in operation, the permanent pipe-tool applies a patch over the leak, and sufficient pressure is applied to stop leak. The patch then can be welded to the pipe, or tool can remain on pipe until it is convenient to weld the patch. Tool and patch are both cadmium treated to prevent rust and corrosion.

Permanent Pipe Patch, Inc., manufacturer of the tool, recommends a cold weld process where welding is hazardous or prohibitive. The permanent patch tools come in two types. The saddle tool will handle pipe up to 6 inches and the chain tool will handle pipe through 54 inches.

For more data, circle **No. E5** on Readers' Service Card, last page this issue.

Write for Bulletin

PIPELINE VENTS AND MARKERS

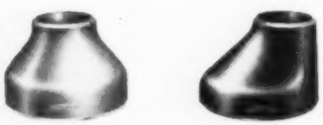
FLEET-LINE CO.
P. O. BOX 276-K
SHREVEPORT
LOUISIANA

Write for Specifications Folder

FLEET-LINE

WELDING FITTINGS

REDUCERS: Concentric and eccentric. Nominal pipe sizes 1" to 30", ASA B16.9, ASTM A234. Schedules 10 to 160, stainless steel, and other alloys. Special lengths and sizes.



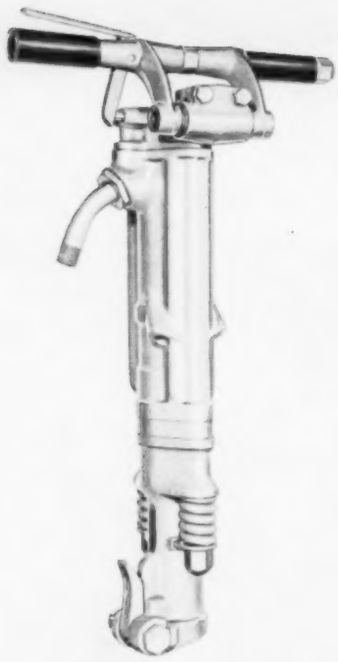
SADDLES: Conventional, and for pressure vessel heads. Nozzle sizes from ¼" to 24". Fleet-Line saddles weld neatly into place in much less time, and with much less welding rod.

Complete encirclement saddles.

Fast interested service.
Write for Literature.

STEEL FORGINGS, Inc.

P. O. Box 276K • Shreveport, La.



Weight Breaker

A new weight breaker with a shock absorbing handle has been developed by Le Roi Division, Westinghouse Air Brake Co. The LB92 is available with a paving breaker, a sheeting driver or a spike driver.

With the handle absorbing 55 percent of the shock and recoil, nearly all vibrations and shock are eliminated from the operator's upper arms, shoulders and head. Vibration is absorbed by rubber cushions incorporated into the mechanism of an offset handle. A positive, end-seating, short stroke valve is precision ground for economical operation, lowering air and oil consumption.

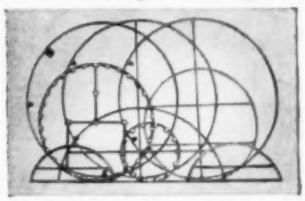
(This item supplements Le Roi Division, Westinghouse Air Brake Company, data on Pages 261-264 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E6** on Readers' Service Card, last page this issue.

Cut-Out Coupling

John Waldron Corporation announces the Anchor Waldron cut-out coupling which provides overload protection, in-

GASKETS
For Every Purpose



HEAT EXCHANGER GASKETS

Made in any size or shape needed in double jacket type. Also cut from solid metal or sheet packing. Write for Bulletin 564.

CORRUGATED METAL GASKETS

Plain or jacketed type. Made of ingot iron, aluminum, stainless steel, copper, brass, nickel and monel in all sizes and shapes. Write for Bulletin 565.

PROMPT DELIVERIES

CHICAGO-WILCOX MFG. CO.

7705 So. Avalon Ave., Chicago 19, Ill.

Add-A-Stack
Custom Line
Type-N
Good-All
CATHODIC PROTECTION RECTIFIERS
Gemco
Low-V

The "Quality" Line

Good-All rectifiers are known the world over for their long life, high quality construction, low maintenance and generous design. These features, in addition to a policy of individual engineering service, have built Good-All's reputation as the world's largest manufacturer of Cathodic Protection Rectifiers.

Electrical Mechanical Division

GOOD-ALL ELECTRIC MFG. CO.
OGALLALA, NEBRASKA

creased misalignment capacity and ease of maintenance.

The coupling's power "shut-off" action occurs at the instant of a dangerous overload where power is transmitted through two in-line shafts and torque limitation is necessary.

Increased stresses and loads on the connected equipment caused by misalignment can be prevented by careful installation of the coupling. The coupling works regardless of direction of rotation. For maintenance only the sleeve of the coupling needs to be moved.

(This item supplements John Waldron Corporation data on Page 474 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E7** on Readers' Service Card, last page this issue.

Teletype

An automatic send-receive teletype set, which operates at 100 words per minute, is announced by the Teletype Corporation. The machine provides facilities for typing, tape punching, tape transmission, tape reception, sending and receiving page copy on message paper or multi-part business forms, plus providing a built-in control system for remote aparatus.

The unit, which measures 39 inches high and 36 inches wide, functions both "off" line locally or "on" line over communication channels.

For more data, circle **No. E8** on Readers' Service Card, last page this issue.

Line Locater

The Wilkinson line locater for determining the precise location and depth of all subsurface installations—pipes, cables, valves, boxes, transmission and distribution lines—is announced by Wilkinson Products Company.

The locater is housed in a moulded glass fiber case which provides ultimate protection for heavy field use. The overall weight, assembled on the connecting handle, has been reduced to four pounds. Transistors have an estimated life of 70,000 hours actual use; mercury cells and high current miniature battery are leakproof.

This locating instrument possesses transmitting and receiving capacity considerably greater than that required for the most difficult locating jobs.

(This item supplements Wilkinson Products Company data on Page 484 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E9** on Readers' Service Card, last page this issue.

Manhattan Aladdin

Up East millions of people simply turn a knob to conjure up a genie Aladdin never dreamed of—a genie of warmth and power. In home and industry, Easterners have Texas-Louisiana gas producers to thank for this genie. Transco, like Aladdin's lamp, is happy to carry the genie where the most people are.

TRANSCONTINENTAL GAS PIPE LINE CORPORATION

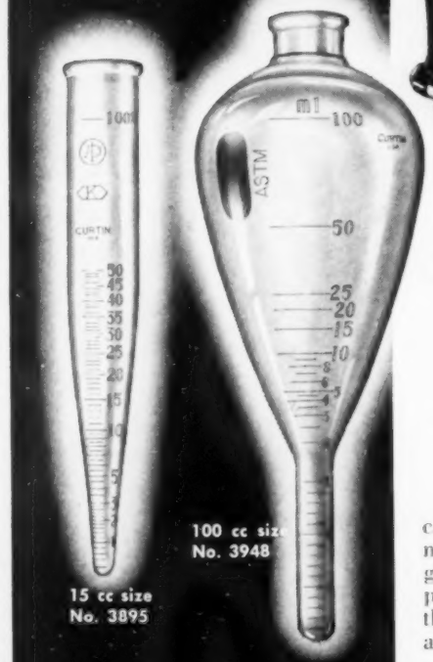
FIRST in their fields

15 cc size
No. 3420-53

CURTIN CENTRIFUGES

- Lightweight
- Rugged
- Dependable

More than thirty years' leadership is reflected in the consistent efficiency and dependable service of the Curtin Series 53 Hand Centrifuges. Some distinctive features are: (1) Rugged, lightweight aluminum castings. (2) Body, crank, spindle nut, and heads interchangeable on both 15 cc and 100 cc models. Trunnion cups replaceable. (3) Crank instantly disengages — no agitation of sediment. (4) Drive shaft and spindle are stainless steel. Spindle shaft is ball bearing mounted for easy turning. Curtin centrifuges meet all API and ASTM specifications. Both 15 cc and 100 cc models are available for immediate shipment.



15 cc size
No. 3895

100 cc size
No. 3948

CURTIN CENTRIFUGE TUBES

- Permanently Marked Graduations
- Retested For Accuracy
- Heavy, Uniform Glass Walls

Curtin centrifuge tubes are accurately calibrated and graduations are permanently marked with white pigment fused into the glass. Graduation lines are fine and sharp to permit easy, quick reading. Every tube is thoroughly annealed for mechanical strength and individually retested for accuracy.

The tubes are of heavy-walled glass with all dimensions carefully controlled for uniformity in size and shape. Tops are finished with a machine tooled reinforced bead. Curtin centrifuge tubes meet API-ASTM specifications and are available in 15 cc and 100 cc sizes. As accuracy in testing B. S. and W. affects profits, specify Curtin Centrifuge Tubes.

FREE CATALOG
Write for 24-page catalog G-56, "Petroleum Gaging Equipment."

W. H. CURTIN & CO.
DOMESTIC EXPORT • CURTIN
PETROLEUM TESTING EQUIPMENT
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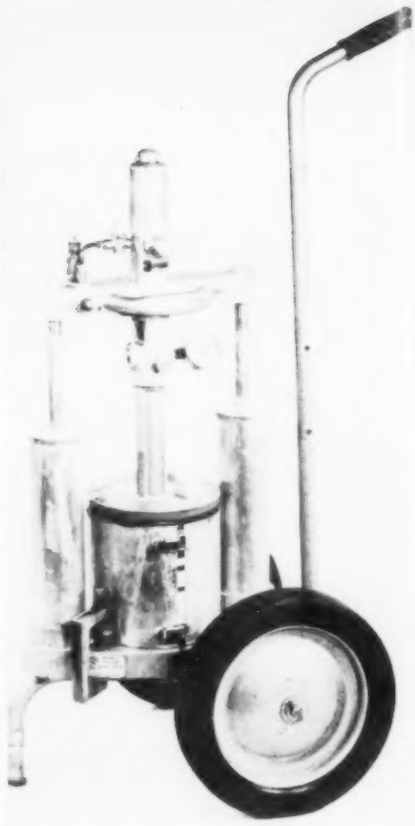
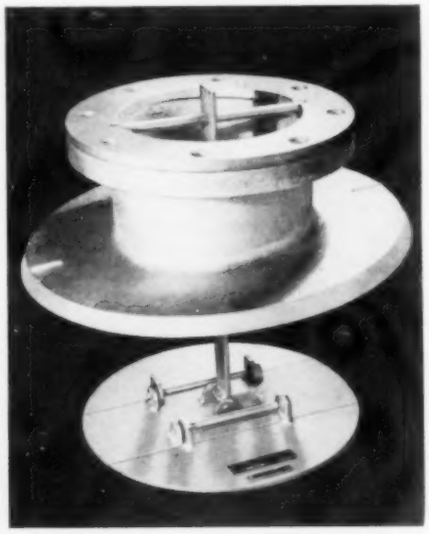


Handcart

Rockwell Manufacturing Company presents a durable handcart designed to provide portability for self-priming air-operated lubricating guns for large scale valve lubrication. The cart can be easily maneuvered up and down stairs and over rough floors and ground.

It has 12-inch rubber tires and weighs 15 pounds. Two standard "C" clamps hold the Hypreguns in place.

For more data, circle **No. E10** on Readers' Service Card, last page this issue.



Vapor Conservation

A mechanical device to reduce evaporation loss in storage tanks has been developed by Shand & Jurs. The "air baffle," placed beneath the vent pipe inlet of gasoline storage tanks, consists of a horizontal

flat plate mounted in alignment with the vent pipe inlet.

Air baffle minimizes the downward velocity of air entering the vapor space through the breather vent thereby reducing one of the forces tending to accelerate evaporation.

For more data, circle **No. E11** on Readers' Service Card, last page this issue.

Hydraulic Sideboom

Another hydraulically operated sideboom for small crawler tractors is announced by Midwestern Manufacturing Company.

Designed for attachment to the Case-Terratrac 600 Industrial crawler tractor with 60-inch gage tracks, it will handle up to 12-inch pipe with a lifting capacity up to 10,000 pounds.

Counter-rotating terramatic transmission, plus torque converter terramatic drive, provides this tractor-sideboom combination with exceptional maneuverability and fast, accurate pipe positioning.

For more data, circle **No. E12** on Readers' Service Card, last page this issue.

Cylinders AND Liners

From Large Stationary Engines Can Be Like New If They Are

dry sleeved At Exline's With **Ni-Chrome** Sleeves.

Sparkey sez, "For cylinder and liner repairs, try . . ."

Exline ENGINE WORKS

SALINA, KANSAS

Box 446 TAylor 3-4683

for heavy duty service

ROCKWELL "WAFER" VALVES

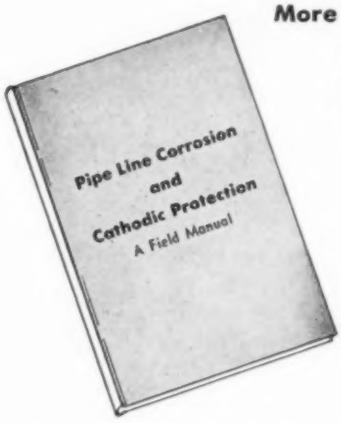
Wafer valve with air motor operator. *Right* — rubber-lined wafer valve with hand wheel control.

Compact, space-saving butterfly valves for dependable throttling and wedge-tight shut-off of air, gas, liquids and semi-solids at differential pressure to 150 psi and temperatures from minus 50° to plus 600°F. and higher. Manual or automatic operators. Standard sizes to 36" and larger special sizes. Write for Bulletin 580.

W. S. ROCKWELL COMPANY

2728 ELIOT STREET • FAIRFIELD, CONN.

Sales Representatives in Principal Cities



More comments on this new Handbook:

". . . a most practical on-the-job manual for men concerned with pipe line corrosion. We are ordering copies for each of our district engineers."

Pipe Line Corrosion and Cathodic Protection

By MARSHALL E. PARKER

This Handbook, written by Marshall E. Parker, consultant, is designed as a practical field manual. It is a 108-page pocket-size volume printed first as a popular series in WORLD OIL. The Handbook is illustrated with many charts and drawings and is completely indexed by subjects.

It presents comprehensive data on Soil Resistivity Surveys, Potential Surveys, Line Currents, Current Requirements, Rectifier Systems, Ground Bed Design, Magnesium Anodes, Stray Current Electrolysis, Interference in Protective Systems, Operations and Maintenance, and Coating Protection and Testing.

An appendix has been added of technical data on Underground Corrosion, Basic Principles of Cathodic Protection, Properties of Metals and Attenuation Equations. Order copies of this practical Field Manual now for each of your field men. Price $3.

Send for your FREE copy of the New Petroleum Book Catalog which describes the nature and contents of many books pertaining to the Petroleum Industry.

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GULF PUBLISHING COMPANY
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HOUSTON 1, TEXAS

Portable X-Ray Unit

A light, high voltage portable X-ray unit for field and plant radiography has been made available by General Electric.

The LX-140 offers effective radiation protection, unitized design, simplified controls and is designed to resist the roughest handling expected of a small unit. The compact unit offers a continuous range from 70 to 140 kvp, and is supplied with a durable plastic case with cushioned interior for safe shipping and handling.

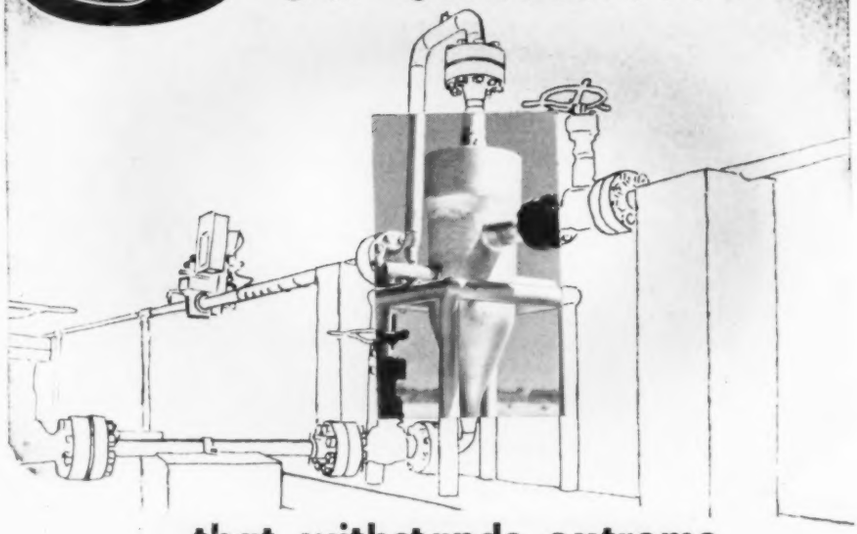
The LX-140 will operate in temperatures from 0 to 120° F., humidity up to 95 percent and altitudes to 5,000 feet.

(This item supplements General Electric data on Pages 181-188 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E13** on Readers' Service Card, last page this issue.

AEROTEC

Gas Scrubber...



...that withstands extreme pressure for reinjection

When gas is reinjected into wells as a reclaimer, or for storage, it must be free of contamination and must be cleaned at high pressures to remove condensate.

Meeting these demands has required an Aerotec gas scrubber in a special pressure shell. Employing Aerotec centrifugal tubes, this unit operates at 4,000 psig and handles 4,000,000 SCFD of gas!

The Aerotec tube assures removal of solids and liquids by centrifugal force, leaving the gas clean and *dry!* Hundreds of Aerotec gas scrubbers are in continuous use on major pipelines. They are the only answer to clean, *dry* gas.

Contact Aerotec Project Engineers for the solution to your gas cleaning problem regardless of pressures involved.

Project Engineers

THE THERMIX CORPORATION

Greenwich, Conn.

(Offices in 38 principal cities)

Canadian Affiliates: T. C. CHOWN, LIMITED, Montreal

Manufacturers

THE AEROTEC CORPORATION

Greenwich, Conn.

Float Switch

Instruments, Inc. announces an air-operated float switch, SnapOmatic.

A positive snap action control that is achieved with a float switch of apparent conventional design is the main feature of the SnapOmatic. The new float-type level controller is available with either a mechanical Tite-Line coupling or with a conventional flanged connection. Horizontal mounting through a side entrance on the tank permits the liquid to raise the float and thus operate the snap-acting valve.

For more data, circle **No. E14** on Readers' Service Card, last page this issue.

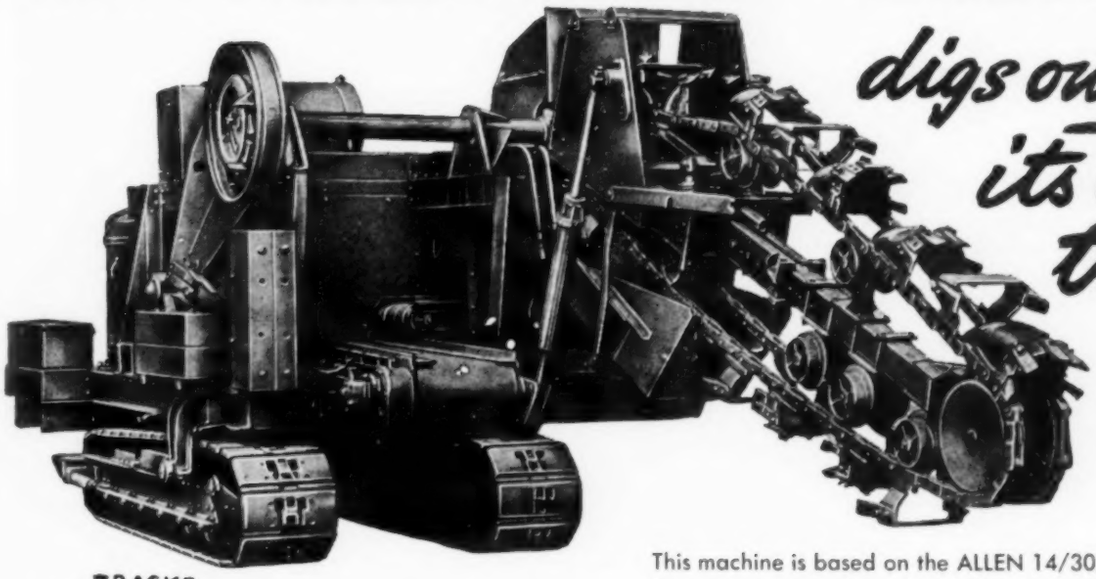
Gate Valve

Hamer Valves, Inc. announces a leakproof gate valve which incorporates telfon seals in the wedge. Named the "Wedge-Seal," this valve marks a radical departure from conventional gate valves. A double seal action enables the valve to provide a positive shutoff both upstream and downstream, eliminating the need for a double block and bleed in piping installation.

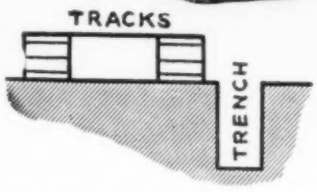
(This item supplements Hamer Valves, Inc. data on Page 217 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E15** on Readers' Service Card, last page this issue.

The ALLEN *OFFSET* TRENCHER



digs outside its own tracks



This diagram shows the position of the trench in relation to the tracks. The middle of the trench is 49 inches from the centre line of the machine.

This machine is based on the ALLEN 14/30, but the digging boom is offset to the right. With this arrangement trenches can be dug very close to obstructions, and in positions where no other trencher could be used.

With a side mounted boom there is considerable lateral stress when working. To withstand this the frame is constructed of massive steel channels, and the drive shaft mounted in a heavy tubular support. Trench widths range from 12-in. to 21-in. Maximum digging depth is 4-ft. 6-in.

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Cement Mortar Lining of Interiors — Centriline Process	..	X	X	16"	144"
Centrifugal Spinning of Cement Mortar Lining of Interiors	X	..	..	4"	30"
Centrifugal Spinning of Coal Tar Linings of Interiors	X	X	..	36"	144"
Somastic® Coating	X	X	..	½"	30"
Concrete Coating	X	..	..	4"	30"
Wrapping	X	X	..	4"	30"
Reclamation:					
Removal of Old Wrapping	X	X	..	2"	30"
Straightening	X	X	..	2"	30"
Blasting (Interior or Exterior)	X	X	..	2"	30"
Beveling	X	X	..	2"	30"
Roll Welding	X	X	..	2"	30"
Testing	X	X	..	2"	30"

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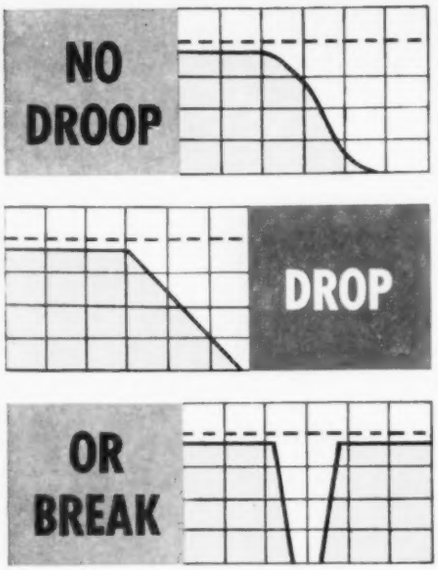

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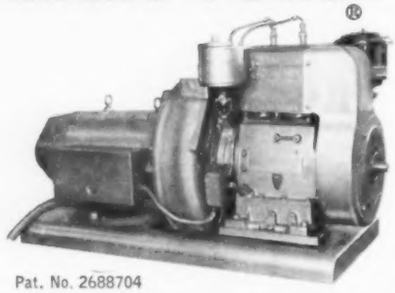

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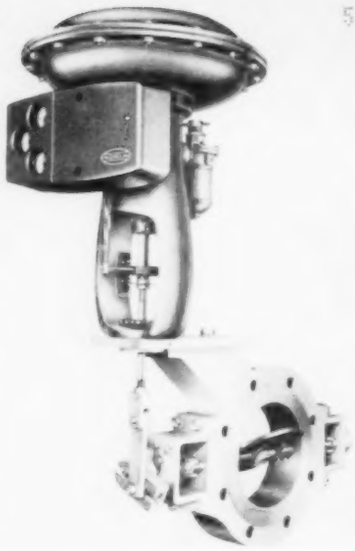

Butterfly Valves

Mason-Neilan offers a new 32,000 series of wafer-type butterfly valves which show major advancements in butterfly valve design. Features of the valves include ruggedized actuator mounting, ease of adjustment, accessibility and maximum actuator power delivery. A special actuator mounting plate has been designed which provides maximum support and makes it possible for the actuator to be adjusted along a slotted plate so that actuator is positioned to deliver maximum power. The series comes with either power, hand wheel or lever actuation. A range from 2 to 24 inches is available in materials of cast iron, cast alloys or flame cut carbon steel; rating to 250 pounds ASA iron and 300 pounds ASA steel.

(This item supplements Mason-Neilan Division of Worthington Corp. data on Pages 275-282 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E16** on Readers' Service Card, last page this issue.

Harringbone Wire Rope

Harringbone wire rope is a new construction employing two pairs of Lang lay strands with two strands of regular lay. It combines flexibility and abrasion resistance of Lang lay with stability of regular lay rope.

This new rope, designed by Wire Rope Division, of John A. Roebling's Sons Corporation, has relatively large outside wire construction to take the pressure and abrasion of contact with sheaves and drums, combined with smaller inside wire construction so patterned as to provide the maximum flexibility in service.

Test results of the wire rope indicate superior flexibility, good resistance to shock and abrasion, easy spooling properties and exceptional structural stability.

For more data, circle **No. E17** on Readers' Service Card, last page this issue.

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are in the NEWS

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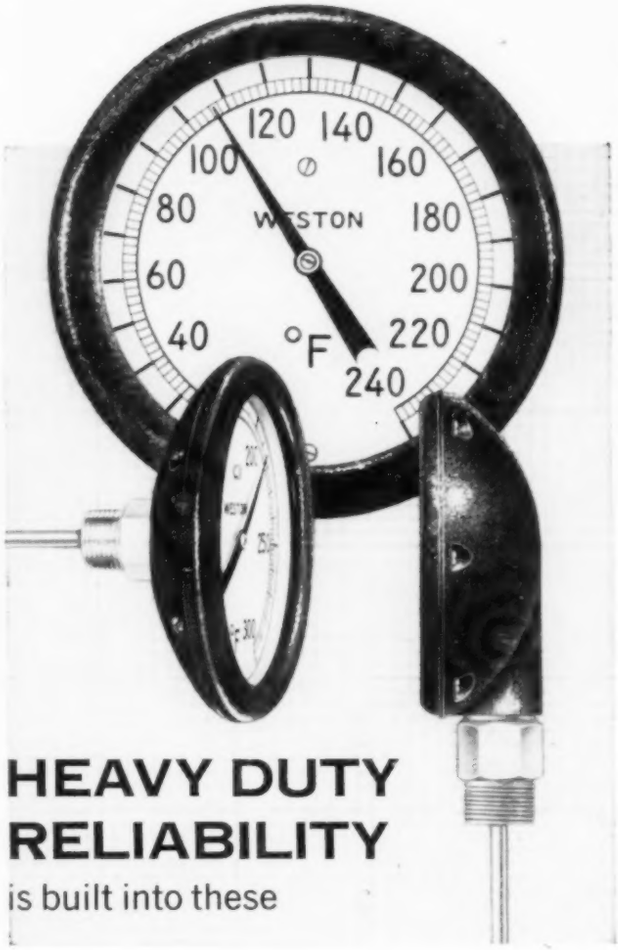

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For lasting accuracy, even under punishing conditions, you can depend on Weston heavy duty bimetal thermometers. Exceptionally stable sensitive elements . . . corrosion-proof, pressure-tested stainless steel stems and connection nuts . . . rugged forged brass heads . . . suit these bimetals for the most strenuous service. Accuracy is assured within 1% of full scale range. 20 standard ranges: running from −100° to 1000°F or −100° to 400°C. Standard stem lengths from 2½″ to 72″.

Model 2221: has a 5″ diameter head with 9″ scale.

Model 2231: 6″ diameter head with 12″ scale.

Model 1221: straight form—basically the same as Model 2221, but with scale parallel to stem. Stem can be located in any one of 24 positions around the periphery of the head.

For full information, call your local Weston representative, or write to Weston Instruments, Division of Daystrom, Inc., Newark 12, N. J. *In Canada: Daystrom Ltd., 840 Caledonia Rd., Toronto 10, Ont. Export: Daystrom Int'l., 100 Empire St., Newark 12, N. J.*

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So SIMPLE We Can Adapt It to ANY LIQUID LEVEL CONTROL JOB

A sleeve, raised and lowered within a non-magnetic tube, attracts or releases an Alnico magnet attached to a mercury switch. Basically, this is Magnetrol.

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● No matter how specialized the liquid level control application, adapting Magnetrol to meet it presents no problem. Whether it's for high pressures, high temperatures, corrosive liquids or any other condition, a few "standard" modifications and the job is done! Operation is so simple no changes in basic design are needed. That's why Magnetrol "fits" practically any application — why "specials" are so often standard with us.

Because of the utter simplicity and dependability of its magnetic principle, Magnetrol has *infinite operating life.* There are no wearing parts to get out of order.

Magnetrols are available for controlling level changes from .0025-in. to 150-ft., with single or multi-stage switching. Our experienced engineering staff is at your service.

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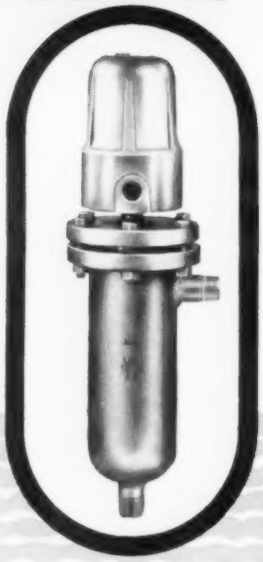

LEVEL MASTER®

The UNFAILING Liquid Level Control!

The ability to function with *continuous, sensitive control* with liquids is the standout feature of Level Master. The "brain" of Level Master is the unique Bell Magnetic Proximity switch incorporating a permanent Alnico V magnet that responds instantly to changes in liquid level!

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- *Horizontal, vertical, external mountings.*
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Send full information on Level Master and name of nearest representative.

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New Equipment Literature

For more data on New Equipment or copies of Catalogs and Literature reviewed in this issue, use the Reader Service postcards just inside the back cover and facing the Advertisers Index. Simply circle code numbers of items desired—sign and mail card.

Planetary Gear Operator

Advantages of the planetary gear operator—for use with hyperseal wrench operated valves handling high pressures—are described in four-page bulletin by Rockwell Manufacturing Company.

The lowcost planetary gear operator is lightweight and compact. With a 5-1 gear ratio and a 4-1 mechanical advantage, one turn of the wrench will close the valve.

The illustrated bulletin also includes an operator selection guide and installation directions.

To get a copy, circle **No. E18** on Readers' Service Card, last page this issue.

Tube-Type Motors

An eight-page bulletin illustrating the redesigned line of TEFC tube-type motors with capsule-mounted split-sleeve bearings is offered by Allis-Chalmers Manufacturing Company.

The bulletin describes the motor's tube-type, air-to-air heat exchanger system, bearing construction, frame, stator and rotor construction. Motors are available in standard and explosion proof designs in ratings from 40 hp at 600 rpm thru 800 hp at 3,600 rpm.

To get a copy, circle **No. E19** on Readers' Service Card, last page this issue.

Gas Engines

Ingersoll-Rand announces three illustrated and colored bulletins describing a line of four-cycle, V-angle gas engines.

The PJVG, smallest of the three, has a horsepower range of 220-295; medium sized PSVG has a range of 408-816 hp; and the large PKVG ranges from 880-1760 hp. They are all essentially the same engines which are built in the company gas engine compressors.

To get a copy, circle **No. E20** on Readers' Service Card, last page this issue.

Solenoid Valve

Magnatrol Valve Corporation offers a bulletin on its hum-free vibrationless solenoid valve designed for use in applications where the transmission of vibrations from ordinary A.C. solenoid valves is either a source of annoyance or cannot be tolerated because of safety or accuracy factors.

The new Type B series full port valves will handle liquids not injurious to bronze at temperatures up to 212° F.

To get a copy, circle **No. E21** on Readers' Service Card, last page this issue.

Your Untapped Treasure

A graphic story of water resources and pumping techniques is shown in a slide presentation entitled "Your Untapped Resources." Layne & Bowler Pump Company's slides show various water-bearing formations, methods of well drilling, and pumping techniques. Descriptions of deep-well pumps and their operation is also included in the story.

To get a copy, circle **No. E22** on Readers' Service Card, last page this issue.

Odorizing Natural Gas

Hills-McCanna Company has issued a two-page bulletin titled "Odorizing Natural Gas." The booklet features the use of McCannameter—a packless proportioning pump—as the core of odorizing systems. Typical requirements of an odorant pump are listed and schematics for integrated systems are shown. Pump capacities and materials of construction are also included.

To get a copy, circle **No. E23** on Readers' Service Card, last page this issue.

Steel Pipe Chart

Midcontinent Tube Service, Inc. offers a schedule chart to aid users of steel pipe. The chart is 17 by 22 inches and presents essential pipe specification information of wall thicknesses, weight and O.D. of seamless and welded pipe under ASA schedules from ⅛-inch to 24-inch.

It is printed for top visibility and can be used on a wall to check references from several feet away. The top and bottom of the chart is made rigid with metal ferrules so that it will hang flat on any wall surface.

To get a copy, circle **No. E24** on Readers' Service Card, last page this issue.

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Serving the Pipeline Industry

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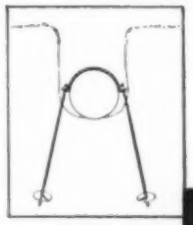
Here's the Fast Easy Way to Anchor Pipelines

No heavy equipment to haul. Cuts costs to a fraction.

Chance Pipe Line Screw Anchors and Brackets greatly simplify pipe line anchoring, compared to other methods, and save many dollars in pipe line construction.

Chance Pipe Line Screw Anchors can be installed in pipe line ditches without extra digging. Using a power wrench the operator merely guides the anchor in place. The tool does the work



Can be installed in the ditch without extra digging.

Write for catalog showing oil industry applications of Chance Earth Anchors.

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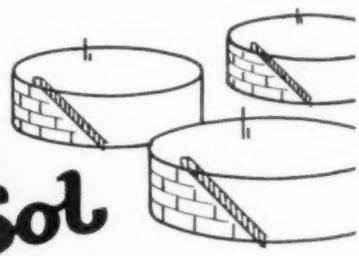
RECLAIM TANK BOTTOMS with BrakeSol



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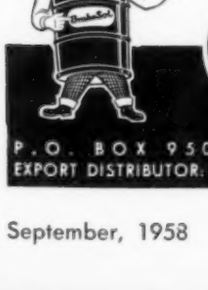

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Reversible ratchet allows fastest possible tightening of 5/8" hex bolts —special 8" handle assures correct torque, as suggested in American Standard Specifications.

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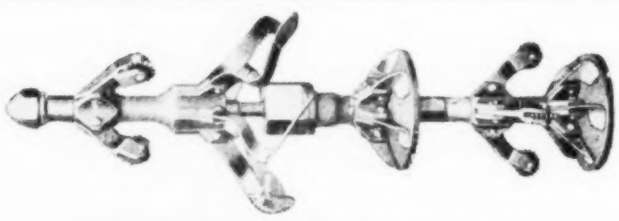
Go-Devil



Standard Model Northrup Go-Devil with leather disc drivers

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Manufacturer of

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UNMATCHED DESIGN FEATURES

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That's why the introduction of this new Bendix S-400 series of magnetos is of such great importance. Here is a magneto that incorporates all of the improvements and refinements of modern ignition design.

Built to aircraft precision standards the new S-400 series is especially rugged so as to deliver trouble-free operation during long periods of service.

It is available in both four- and six-cylinder flange-mounted models in weatherproof, unshielded and radio-shielded versions.

For the important jobs where continuous top performance is a must, the new Bendix S-400 series magneto is the logical choice. Why not write today for complete details and specifications of this modern industrial engine magneto.

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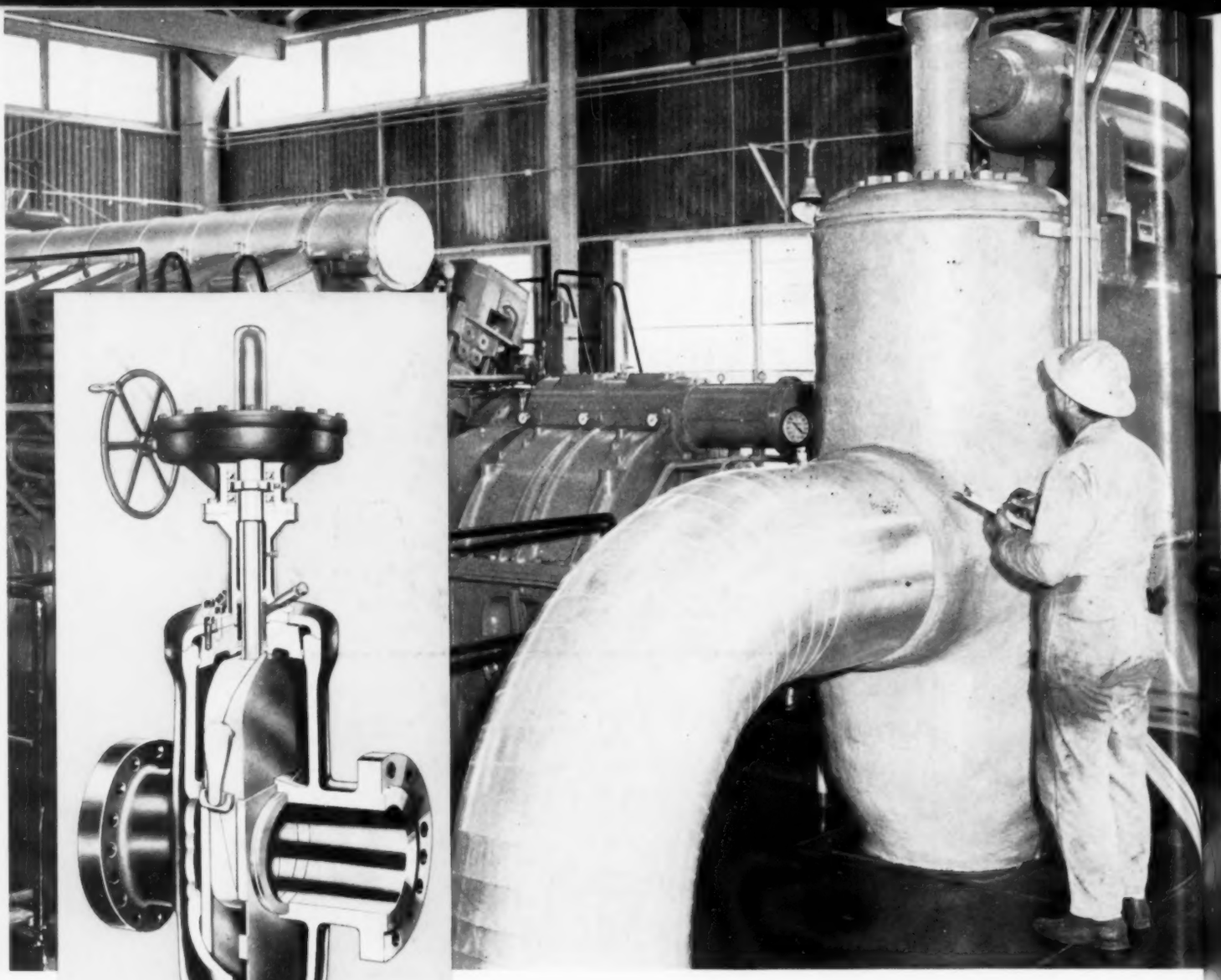

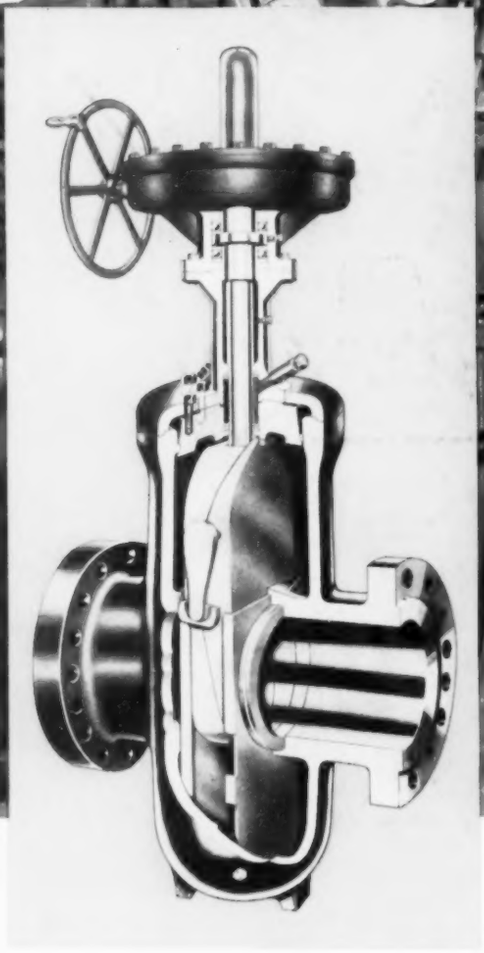

W-K-M's *Creative Engineering*

sets the standards for pipeline valves around the world

From 2-inch to 34-inch, W-K-M's ASA gate valves have earned the commendation of pipeliners from California to Iran, from Peru to Canada.

And why not?

No other pipeline valves are so carefully engineered to meet the practical requirements of pipeline service. No other valves will give you the same performance, the same long life, the same long-range economy.. No other valves can be so easily or quickly overhauled "on-the-line."

For complete dependability, specify W-K-M when you requisition valves.

The W-K-M® ASA Gate Valve can be overhauled "on-the-line"

W-K-M designed this valve to save you time and money. W-K-M valves give you longer service between overhauls, and when overhaul is necessary, you can do the job while the valve is *on-the-line*. This one feature saves users of W-K-M valves thousands of dollars each year.

Other features include: Full bore through-conduit; exclusive gate centralizing mechanism; freedom from destructive turbulence; no-surge operation; free passage for pigs or scrapers.

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